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WELFARE WORK AND PUBLIC POLICY.

It is significant of the success with which the National Electric Light Association clearly distinguishes the great public movements of the times that the public policy committee devoted its entire report this year to the single topic of welfare work. Standing by itself and without the distracting influences which a consideration of a number of other subjects would have involved, the study of this topic assumes a prominence that could have been given to it in no other way. It is a concise, masterly treatment of a feature of corporation management which deserves careful consideration and introduction wherever practicable in the united interest of all who are concerned. It is at once broad in its recognition of a right public policy and exact in its definition of the restrictions and limitations with which reasonable systems of welfare work should be safeguarded. The committee recognizes with wisdom that the question of wages and the question of welfare work are separate and distinct. The question of wages is a business one; the issue involved in welfare relations between company and employee should be a better thing than a gift from one to the other. Great emphasis is given to the recommendations in the report by the influence of the names of the members of the committee by which it is issued. But it is connected still more closely with the public thought of the times and with the electrical industry by reason of its presentation with the support of the thoughtful address of Mr. Insull and the commendatory message of the Secretary of the Department of Commerce and Labor. It is the pride of the electrical industry that it has been in advance of the times and never a laggard in development. With good reason the association may point to the result of the year's consideration of questions of public relation as a commendable document, but it rests with the individual member companies to go further and make the recommendations effective. If, as Mr. Insull indicates, the real test of welfare work is to come when the companies include the cost in the rates of service, the issue is one that it is not best to postpone too long.

THE CONVENTION.

So much business of importance was considered at the great and enthusiastic New York convention of the National Electric Light Association now closing that it is rather difficult, while the atmosphere is still electric with the enthusiasm, the fellowship and the joyous excitement of the whole affair, to summarize results. One event, however, is of outstanding importance, and that is the public-policy report presented at the New Theatre on Wednesday evening. This report on welfare work for employees is not only of the highest importance as indicating a very advanced position taken in reference to the wellbeing of employees of member companies, but it cannot be overlooked that its official adoption reveals a public-spirited attitude on the part of the association which can hardly fail

to affect favorably relations with communities in which the employees live. Thus the influence of this official welfare recommendation should be widespread.

The attendance at the convention was amazingly large, reaching a total of about 5150, almost exactly double the figure attained at the St. Louis convention of 1910, which held the record up to this year. This tremendous gathering was partly due to the fact that the meeting was held in New York and to the great attendance of company section members, but in large part is to be attributed to the continued growth of the industry, which, as Mr. C. A. Coffin said in his speech, is, or should be, an inspiration to every man engaged in it. Perhaps the greatest figure in the industry, Mr. Edison, attended the convention, and thereby added to its prestige in the eyes of the general public, while giving the convention attendants an appreciated opportunity to render a tribute of admiration.

In the space and time available it is impossible to review or even to mention all the committee reports and papers presented and discussed at the convention. Many of them are of distinct value, and individual reference is made to the principal features of this character elsewhere in the general report of the convention and the sections giving abstracts of the papers and discussions. It may serve to indicate the amount of business considered to say that the stenographic transcript of the discussions alone makes more than 1000 typewritten pages. The concomitant features of the convention, as the presentation of cups, meetings "on the side," dinners, luncheons, etc., were numerous and interesting. The arrangements for the convention were most complete; the entertainment features were on an unparalleled scale, the New Yorkers showing every courtesy to the visitors, and in every respect the convention has been, beyond all question, the greatest in the history of the association.

THE VENTILATION OF TURBO-GENERATORS.

In view of the fact that the permissible output rating of alternating-current generators is set almost wholly by a limiting temperature beyond which it is considered unwise to operate the machine, it needs no argument to show that one of the most important problems confronting the designer of the apparatus is that relating to the means for dissipating the heat produced within the machines as unavoidable losses. The thermal problems become more difficult of solution as the ratio of loss to unit mass of material increases, and reaches the extreme in this direction in the very high-speed steam turbo-generators, in which the ratio of the loss to the volume of the material throughout which the temperature is affected is greatest. Under conditions now met in generating-station practice, where low inherent regulation is of minor importance, it may safely be stated that the permissible output of any chosen alternating-current generator varies directly with the effectiveness of the facilities which are provided for cooling the machine.

A good idea of the magnitude of the thermal problems encountered by the designer of a turbo-generator was given in a N. E. L. A. convention paper by Mr. R. B. Williamson, abstracted in this issue. The author shows that, in the very limited passages that can be provided within the generator, approximately as great a weight of air must be passed as the weight of steam consumed by the steam turbine. The prejudice which formerly existed against the use of so-called artificial means of ventilating generators is slowly disappearing as the users of electrical apparatus are educated to appreciate the important relation between ventilation and cost of equipment. The centrifugal ventilating fan is now a well-recognized adjunct to the turbo-generator, and even at the present time not all of the fans are hidden from view within the generator casing. Probably there exist frequently conditions under which separately driven fans would prove more convenient and effective than the self-contained ventilating equipments. The time seems now to have arrived when such an auxiliary cooling installation for a turbo-generator unit can be looked upon just as is the similar installation for cooling transformers, and not as indicating poor design and construction, as would have been assumed to be the case in earlier years.

THE DIELECTRIC CONSTANT FOR ICE.

If we consider a rectangular slab of insulating material, assumed initially as a perfect non-conductor, then we know that if there be a varying difference of electric potential across the slab electricity will pass across the slab and that the rate of flow at any instant will be proportional to the rate of change in the impressed potential-difference. For slabs of different material of the same dimensions, and for given rates of change of impressed potential-difference, the electric current through the slabs is materially different. The least current of all is found with a slab of vacuous space, or what may be called a slab of free ether. Slabs of gases at ordinary temperatures and pressures carry but little more current than slabs of vacuous space. Solids always carry more, and much more. The ratio of the current through a slab of given uniform insulating material to that through a slab of vacuous space is called the dielectric constant of the material. When, as frequently happens, appreciable conductive leakage of electricity occurs through the slab, in addition to the dielectric transfer, a deduction has to be made for the leakage. In magnetics a somewhat similar phenomenon occurs. When a slab of material has a difference of magnetic potential applied across it, a magnetic current passes through it. With slabs of different materials, however, the magnetic current is always nearly the same as for a slab of vacuous space, unless we use a slab of a magnetic metal, such as iron, nickel or cobalt, when the magnetic current is commonly increased. In these cases the increase is due to the generation of molecular magnetic sources within the structure of the magnetic metal.

In the case of dielectrics we usually consider that the dielectric constant indicates a greater electrostatic conduction in the substance than exists in air or in vacuo. We do not attribute this to an e.m.f. evoked structurally in the material. It is as though a storage battery were allowed to discharge in succession through a number of different wires, all of the same dimensions, but of different substances. Those wires which received the largest currents would be regarded as possessing the greatest conductivities. But it would be conceivable for the wires all to possess the same conductivity and to have a structure of molecular sources of e.m.f. capable of being oriented and connected in series to assist the passage of current

flow from the storage battery. The distinction between the effects of structural e.m.f. and those of difference of conductivity would be looked for in the persistence or non-persistence of current flow. In the one case there would be a residual current flow analogous to residual magnetism in a steel ring. In the other case there could be none. The dielectric constant of water and of ice is large compared with the dielectric constant of most substances. The constant of solids commonly varies between 2 and 8, but in the case of ice it has been observed to be as much as 95. Much depends upon the frequency used and on the method of measurement in such cases. An experimental research by Mr. Phillips Thomas, published recently in the *Physical Review*, made the constant for ice from 94 to 96, at temperatures from —2 deg. C. to —18 deg. C. and frequencies from 40 cycles to 70 cycles. It is to be hoped that the measurements will be extended up to high frequencies and down to low temperatures.

MORE CHICAGO ENTERPRISE.

The Commonwealth Edison Company of Chicago has already made an extraordinary record for successful activity and remarkable energy in building up new business and providing station equipment in ample time to take care of it. So far as we can remember this company has never allowed its needs to get ahead of its resources, and it has gone ahead with a wonderful breadth of perspective to enter upon new fields and exemplify in every respect the largest view of central station business. The notable Northwest station described in our columns this issue is an admirable example of the way in which the big policies of the Commonwealth company have been carried out. It is perhaps the largest steam-driven power station now under construction, and when completed, if completion is not too long delayed, will in all probability hold the record as the largest steam-driven station in existence. Mere bigness, however, does not count in central-station design so much as wise arrangement and skilful adjustment to the needs of the situation. The Northwest station embodies all of this.

In the first place, its construction carries out the policy of the Commonwealth company of not putting all its eggs in one basket, for the engineers evidently realize fully that there is a maximum size of station beyond which mere increase of size does not pay. Instead of trying to unify the supply for the whole territory served, they have followed the wise theory that when generating stations of immense size have to be erected they may just as well be located in advantageous positions with respect to the whole problem of generation and distribution as collected under one colossal roof to satisfy a crude desire for aggregation. Hence the Northwest station has been carefully located eight miles from the present chief station in a position where there is ample room for growth and a good opportunity for fuel and water supply. More than this, the new plant really consists of two independent units, each of which when completed will have 120,000 kw of generating rating. The present beginning contemplates the immediate installation of two 20,000-kw turbines out of the six assigned to one-half of the completed design. These turbines will be operated at higher pressure and hence at even greater economy than those now in use, which, we believe, hold the present record for cheap generation of energy.

A glance at the station plan shows the arrangement as it has been at present developed, and it is indeed illuminating as regards the existing situation in prime movers. The huge 20,000-kw turbines are spaced more closely than the 12,000-kw units now in use, giving a material gain in floor space, even although in the situation occupied by the station this is of itself not essential. It is very clear that at the present moment the prime mover has outrun the steam-generating equipment in development. Twenty boiler units are required to feed with steam the two great turbo-generators of the station. The turbine-room seems a mere annex to the boiler-room, and in fact the transformer house and the switch house between them take up more space than the turbine-room. One cannot help wondering when the boilermakers will rise to the occasion and build units more nearly adequate for the steam supply of the great generators now in use. Practice abroad is already tending toward an increase in the size of boiler units, and a glance at the floor plan of this Northwest station emphasizes the need and arouses a feeling of wonder that the builders of generators have been allowed to get so far ahead of the game. The usual excuse is that it is not "feasible," or "practicable," or "economical," or "conservative," or something else of the same kind, to produce larger boiler units than the "standard" ones now in use. A decade hence, however, engineers will grin at the remembrance of our present practice. They may also smile indulgently at our present intricate methods of switching.

This reference to switching is not offered in criticism of the admirable work of the engineers of the Commonwealth Edison Company in the design of this station, but merely in hope that some day a larger view of the whole problem may be acquired to which the art of construction may grow. From a practical standpoint the present great elaboration of switching mechanism brings a new danger in station operation, the risk of crippling the cable connections that lie between the generator and the distributing house. More than one big station has in the last year or two been put out of business with disastrous results, not by failure of the generating apparatus, but by the wholesale destruction of its connections. But, taking apparatus and methods as they are, the Northwest station is an admirable example of design. Some of its most valuable and ingenious features are found in the boiler-room, where the coal-handling equipment is of a most perfect and complete kind. The coal cars run into the basement of the boiler-room and are discharged by automatic machinery, which takes care of the coal from its reception to its combustion with a minimum of hand labor. Even the ashes are carried away by ash cars run under the furnaces for their reception. No more complete plant for economical and efficient handling of fuel has ever been devised. The fuel is brought to the station on an electric elevated road, and besides the large storage capacity provided in the boiler-house bunkers provision is made for immense storage capacity in the yards. Not the least commendable feature of the great plant is the systematic effort that has been made to relieve it of the grimy utilitarian appearance only too common and to make it as dignified and ornamental as possible. This is but the part of the larger conception of central-station responsibility for which the Commonwealth company has been conspicuous. Altogether the new plant is a remarkable example of skill and foresight as applied to electrical supply.

A. I. E. E. Convention.

Arrangements have been completed for the annual convention of the American Institute of Electrical Engineers, to be held in Chicago at the Hotel Sherman from June 26 to 30. Among the entertainment features will be a reception and dance at the hotel on Monday evening, June 26. On Tuesday afternoon visits will be made to the factory of the Western Electric Company and to the generating stations of the Commonwealth Edison Company. On Wednesday afternoon there will be a reception for the ladies at the South Shore Country Club. On Wednesday evening there will be a boat excursion on Lake Michigan. On Thursday afternoon a visit of inspection will be made to the Indiana Steel Company's plant at Gary. There will be additional entertainments provided for the ladies, including automobile trips, details of which have not yet been decided upon.

A partial list of the papers to be presented was given in our issue of May 4. The complete technical program is as follows:

POWER-STATION SESSION, TUESDAY MORNING.

The opening session will be held at 10 o'clock on Tuesday morning, the first item on the program being the presidential address by Prof. Dugald C. Jackson, of the Massachusetts Institute of Technology, Boston. This will be followed by the address of President-elect Gano Dunn, of the Crocker-Wheeler Company. Dr. C. P. Steinmetz, General Electric Company, will present a paper entitled *Development of the Modern Central Station.* A paper entitled *Tests of Oil Circuit-Breakers* will be presented by Mr. E. B. Merriam, of the General Electric Company. *The Use of Reactance Coils in Large Central-Station Systems* is the title of a paper which will be presented by Messrs. R. F. Schuchardt and E. O. Schweitzer, of the Commonwealth Edison Company.

ELECTRIC-LIGHTING SESSION, TUESDAY EVENING.

At a session to be held at 8:30 on Tuesday evening the following two papers will be presented: *Depreciation as Related to Electrical Properties,* by Mr. Henry Floy, of New York, and *Important Features Entering Into the Making of Appraisals,* by Mr. H. M. Byllesby, of Chicago.

RAILWAY SESSION, WEDNESDAY MORNING.

The following papers will be presented at a session to be held at 10 o'clock on Wednesday: *Some Data from the Operation of the Electrified Portion of the West Jersey & Seashore Railroad,* by Mr. B. F. Wood, of the Pennsylvania Railroad; *Analysis of Electrification,* by Mr. W. S. Murray, of the New York, New Haven & Hartford Railroad; *Solution of Problems in Sags and Spans,* by Mr. W. L. R. Robertson, of the Philadelphia Electric Company, and *Induction Machines for Heavy Single-Phase Motor Service,* by Mr. E. F. W. Alexanderson, of the General Electric Company.

INDUSTRIAL POWER SESSION, WEDNESDAY AFTERNOON.

At 2:30 Wednesday afternoon the following papers devoted to the application of motors in industrial service will be presented: *Automatic Motor Control for Direct-Current Motors,* by Mr. Arthur C. Eastwood, of the Electric Controller & Supply Company; *Some Limitations of Rheostat Control,* by Mr. T. E. Barnum, of the Cutler-Hammer Company; *Control of High-Speed Electric Elevators,* by Mr. L. I. Tatum, of the Cutler-Hammer Company; *Electrically Driven Reversing Rolling Mills,* by Mr. Wilfred Sykes, of the Westinghouse Electric & Manufacturing Company.

TELEGRAPHY AND TELEPHONY SESSION, WEDNESDAY AFTERNOON.

Simultaneously with the holding of the industrial power session there will be held a session devoted to telegraph and telephone subjects, at which the following papers will be presented: *Multiplex Telephony and Telegraphy by Means of Electric Waves Guided by Wires,* by Major George O. Squier, U. S. A.; *Telegraph Transmission,* by Mr. F. F. Fowle, of Chicago; *Commercial Loading of Telephone Circuits in the Bell System,* by Mr. Bancroft Gherardi, of the American Telephone & Telegraph Company.

HIGH-TENSION TRANSMISSION SESSIONS, THURSDAY AND FRIDAY.

The following papers relating to high-tension transmission problems will be presented on Thursday and Friday. *The Law of Corona and the Dielectric Strength of Air,* by Mr. F. W. Peak, Jr., of the General Electric Company; *Mechanical and Electrical Characteristics of Transmission Lines,* by Dr. Harold Pender and Mr. H. F. Thomson, of the Massachusetts Institute of Technology; *Dielectric Strength of Air,* by Prof. J. B. Whitehead, of Johns Hopkins University; *Sag Calculations of Suspended Wires,* by Mr. P. H. Thomas, of New York; *Transmission System of the Great Western Power Company,* by Mr. J. P. Jollyman, San Francisco; *Transmission System of the Southern Power Company,* by Mr. W. S. Lee, Charlotte, N. C.; *Transmission System of the Great Falls Power Company,* by Mr. Max Hebgen, of Butte, Mont.; *The High-Efficiency Suspension Insulator,* by Mr. A. O. Austin, of the Ohio Insulator Company, and *Electric Line Oscillations,* by Mr. G. Faccioli, of the General Electric Company.

CONFERENCE OF SECTION DELEGATES, FRIDAY EVENING.

A conference of Institute officers and section delegates will be held under the auspices of the sections committee at 8:30 on Friday evening.

GENERAL SESSION, FRIDAY MORNING.

The following papers on general electrical engineering subjects will be presented at a session to be held at 10 o'clock on Friday: *The Economical Design of Direct-Current Electromagnets,* by Mr. R. Wikander, of Pittsburgh; *Electrolytic Corrosion in Reinforced Concrete,* by Prof. C. E. Magnusson and Mr. G. H. Smith, of the University of Washington; *Wave Shape of Currents in an Individual Rotor Conductor,* by Mr. Hans Weichsel, of the Wagner Electric Manufacturing Company; *The Choice of Rotor Diameter and Performance of Polyphase Induction Motors,* by Mr. Theodore Hoock, of the Westinghouse Electric & Manufacturing Company; *The Application of Current Transformers in Three-Phase Circuits,* by Mr. J. R. Craighead, of the General Electric Company, and *The Cost of Transformer Losses,* by Messrs. R. W. Atkinson and E. C. Stone, of the Standard Underground Cable Company.

EDUCATIONAL SESSION, FRIDAY AFTERNOON.

At 2:30 on Friday afternoon the following papers on educational subjects will be presented: *Tentative Scheme of Organization and Administration of a State University,* by Mr. Ralph D. Marshon, of New York.

Report of Central-Station Load-Factor at Turin International Electrical Congress.

Prof. G. Sartori has been invited to prepare a report on the problem of increasing the load-factor in central stations for presentation before the International Electrical Congress in Turin in September. Professor Sartori, whose address is 727 Via Michelangelo, Trieste, Austria, will be very glad to receive from American central-station men communications on the subject.

Pittsburgh Meeting of A. S. M. E.

The spring meeting of the American Society of Mechanical Engineers convened at Pittsburgh on Tuesday, May 30, the headquarters being at the Hotel Schenley, with an attendance of about 600. The opening day was devoted to registration and a reunion of the members and their friends. A meeting of the council of the society was held in the afternoon, Col. E. D. Meier, president of the society, presiding. In the evening an informal reception was held at the hotel, the officers of the

society being assisted in receiving by several prominent citizens of Pittsburgh.

Wednesday morning was devoted to the cement session, at which there were papers and discussions of the cement-making industry. In the afternoon a special train was run to Universal, Pa., where an inspection was made of the plant of the Universal Portland Cement Company. On the return trip the party was taken through the works of the Westinghouse industries at East Pittsburgh.

ENERGY RELATIONS IN STEAM TURBINES.

On Thursday morning at the miscellaneous session Prof. Forest E. Cardullo, of the department of mechanical engineering of the Agricultural and Mechanical College of Vermont, read a paper on the calculations of the distribution of energy and pressure drop among the stages of an impulse turbine. Professor Cardullo stated that there are three general methods open to the designer for determining the properties of steam during its passage through the turbine: First, empirical equations giving the relation between heat content, entropy and temperature or pressure of expanding steam; second, by use of Mollier's total heat-energy diagram giving the relation between the total heat, entropy, pressure and quality of steam; and third, making use of a table showing the relation between the temperature, entropy, total heat, quality and specific volume of steam, similar to the one given by Prof. C. H. Peabody before the Society of Naval Architects and Marine Engineers at the Detroit convention in 1909. The author suggested as a substitute for the last mentioned a method which he believes to be simpler and more exact. Professor Cardullo stated that there is no known reason why this method should give correct results, but experience shows that it does.

It is customary to design multi-stage impulse turbines on the assumption that the entropy of the steam remains constant, but the effect of the friction of the steam is to increase the total heat and the entropy of the steam. It also increases the proportion of the power developed in the later stages. The author proposed an empirical formula for estimating the power developed in each stage, and this formula can also be used in the determination of the proper pressure drop of each stage.

The author gave a graphical solution of the problem in connection with Mollier's total heat-entropy diagram. This method he recommended when the amounts of power developed by the different stages are unequal, as is sometimes the case.

THE PURCHASE OF COAL.

Mr. Dwight T. Randall, of Boston, formerly employed by the government in research work, but now engaged in consulting engineering work, at the Thursday morning session read a paper on the purchase of coal. He stated that most boiler-rooms are now able to effect economies in two ways, namely, by burning the coal in the most approved manner and by carefully selecting the coal best suited to the conditions—that is, the one that would give the most heat units per dollar expended.

Coals purchased in the open market differ widely in quality, though sold under the same trade name. An intimate knowledge, therefore, should be had of the coals to be selected from and also of the combustion operation. If coals are suited for the furnaces in which they are to be used the output is proportional to their heating value. In some cases it has been found economical to alter the furnace in order to utilize a low grade of coal. A great deal depends on the knowledge the operating department has of the boiler-room and reasons for variations in economy obtained, and low efficiencies charged to poor coal are often due to lack of this knowledge.

It is very generally conceded now that the proper method of buying coal is by analysis, with a guarantee as to its quality, with some provision for variations from the guarantee. A great deal depends on the sample, and extreme care should be used in selecting this, taking it from all portions of the car or barge. Very different results can be obtained from samples from the same vessel, and it is therefore incumbent to select an average sample.

The method of burning coal after the proper kind has been selected should also be carefully studied. Poor combustion operation will nullify the advantage gained in having obtained the correct coal.

Electric Vehicle Club Meeting at Boston.

At the regular meeting of the Electric Vehicle Club of Boston on May 24 Secretary L. D. Gibbs called attention to the far-reaching influence of the Boston Edison company's electric-vehicle publicity work, citing favorable comments upon it from England. He announced that the Boston Edison company is ready to send letters to lists of prospective customers, casting the weight of its influence for electric vehicles. This circularization is not permitted in connection with the company's bills, but will be handled in a strictly confidential way without displaying any partiality between different makers.

The committee on the electric-commercial vehicle parade for May 30 announced that the owners of sixty-two trucks have expressed their willingness to enter, and a striking comparison with the horse-drawn vehicles of the annual work-horse parade was anticipated. The committee on parking stated that an effort is to be made to secure rights on Charles Street, between Boston Common and the Public Garden. Negotiations on behalf of Hamilton Place, nearer the business center, had been unavailing. Mr. J. Allen Smith, president of the National Battery Company, Buffalo, N. Y., emphasized the importance of securing parking space and said that electric pleasure vehicle progress in Boston depended to no small extent upon liberal treatment of automobile owners by the public authorities.

Mr. E. S. Mansfield said that the Massachusetts automobile register showed that on May 20 there were 1274 commercial automobile trucks and vehicles operating in the State. Of these 123 are of the electric type and sixty-one are in the Edison district. About 108 new electric machines of all types have been sold in Boston this year. The meeting closed with a somewhat protracted discussion of the evils of demonstrating cars and the importance of properly caring for batteries in order to secure the life guaranteed.

Water-Power and Conservation.

At the noon luncheon of the Chicago Electric Club May 24 Mr. I. E. Brooke, of the W. H. Rosecrans Engineering Company, presented a paper on the subject of "Water-Power and Conservation," which, in his absence, was read by Mr. C. E. Freeman. Mr. Brooke's paper directed attention to the enormous fuel costs which must now be paid owing to the non-development of existing water-power. In addition to the coal actually used for fuel purposes, the author pointed out that for each ton of coal hauled across the continent approximately another ton must be burned under the boiler of a locomotive. In this country alone there are 33,000,000 hp of waterfalls not yet utilized, the development of which would mean a saving of $200,000,000 in fuel costs annually. With proper storage facilities the above undeveloped water-power could be made capable of producing 150,000,000 hp, which would be equivalent to 50 per cent more than an average year's coal consumption at the present rate. At the present time about 5,000,000 hp is being developed by about 5000 different waterwheels in this country.

The influence of forests on stream flow and annual run-off was also discussed by Mr. Brooke, who enumerated the various popular arguments which friends of the forestry movement have put forward tending to show that forests conserve uniform stream flows. These statements the author characterized as fallacies and showed that in many instances where timbered land had been cut off the stream conditions remained practically unchanged. He also declared that the influence of forests, if any, must be very small and totally disproportionate to effect any storage of the scale required. While under average flow conditions, the speaker admitted, the forests might be expected to conserve and regulate run-off to a small

extent, they could have practically no effect on the extreme flood conditions, some of the most severe of which are encountered in regions thickly covered with timber.

Mr. Brooke called attention to the use of combination irrigation and power-development plants and suggested that such developments should be undertaken by engineers familiar with the combined problems of power generation and water supply so that neither one of these important phases would be overlooked in sites available for the double purpose. The improper construction of one plant or the other often results in prohibiting any future developments of the other undertaking. Mr. Brooke spoke of the increasing stability and value of water-power securities, and suggested methods by which these values might be increased by government supervision and regulation. The author then referred to water-power control in France and Italy. The laws of the latter, he declared, are most admirable in their completeness and thoroughly fix the conditions of diversion, use, quantity and restoration, and the sanitary conditions surrounding the development. Water-powers are leased to operating companies at 55 cents per hp-year on a thirty-year term, which is renewable for a second thirty-year term, although further renewals are optional with the government. If the power company cannot show a development of all of the power allotted the lease is revocable. The Italian government considers the difference between a generating plant supplying service within a closely settled community and one where transmission of the power developed is necessary. For all transmissions above 10 km in length it allows a reduction in the 3-franc rate per hp-year proportional to a number equivalent to the square of the kilometers of transmission distance multiplied by one-thousandth, the rental in no case, however, being less than ½ franc, which applies to all transmissions above 50 km in length. In France all water-powers above 200 hp are regarded as municipal or public-service plants, while those below this rating are regarded as private plants and are supervised as such. In Switzerland the limit is 100 hp for public-service plants.

Proposals have been made by those taking suggestions from the government's construction of irrigation plants to have water-powers built by the government and leased to private parties for operation. Mr. Brooke declared that this course would not be satisfactory on account of the higher cost at which government plants are constructed as well as the incident formality of government control, which might repel investors. On the other hand, the presence of the government in the undertaking would no doubt lend stability to the character of the investment. Mr. Brooke advocated extending the right of eminent domain to water-power and transmission companies, as is done in the case of railroad companies, to bring about the greatest benefit to the greatest number. He also pointed out that the proposed tax upon water-power is about forty times that provided in the coal lands, which the government is selling at an estimate of 0.1 cent per ton of coal.

The Electric Club of Chicago has voted to tender a complimentary luncheon to the members of the American Institute of Electrical Engineers during the latter's convention at Chicago in July.

Expansion of Electric Vehicle Business at Boston.

As a result of the vigorous campaign inaugurated about three months ago by the Edison Electric Illuminating Company of Boston in co-operation with nearly a score of representatives of manufacturers the demand for the electric commercial and pleasure vehicle is rapidly increasing in the company's territory. In the publicity work fostered by the Electric Vehicle Club larger advertising space is continually being taken in the Boston press by dealers in electric vehicles and accessories, and a more favorable attitude is being displayed by newspaper managements toward this type of equipment. Space is being given to articles of electric vehicle interest as a feature of issues in which competitive makes are advertised together, and a vigorous effort is being made to show the public that the gasoline car has no monopoly in the territory. Among the recent decisions favorable to the electric vehicle is one by the publishing house of Ginn & Company, Boston, which has concluded after exhaustive service tests of three delivery wagons to dispense entirely with horses and to install a private garage for charging and maintenance by the company's own staff. The George W. Gale Lumber Company, Cambridge, Mass., will shortly place three tractor trucks in service, replacing all the horses required to handle twelve lumber wagons. The Carpenter Garage & Motor Company, Brookline, Mass., has recently installed charging equipment capable of handling twenty-five machines simultaneously, including a switchboard permitting the taking of readings on individual batteries and thus obviating troubles which have sometimes hampered the older garages.

Meeting of New England Section, Electric Vehicle Association.

The regular monthly meeting of the New England Section of the Electric Vehicle Association of America was held at the Edison Building, Boston, Mass., on the evening of May 26, with President E. S. Mansfield in the chair. Before the address of the evening, which was by Mr. L. D. Gibbs, superintendent of advertising, Boston Edison company, on "Advertising in Relation to the Electric Vehicle," a short business meeting was held. Mr. Day Baker stated that the committee on parking had been successful in obtaining permission from the Boston Police Commissioner for the use of the portions of Tremont, Park and Beacon Streets fronting on Boston Common by owners of electric vehicles desiring to keep their cars standing downtown on shopping excursions. The authorities have informed the committee that the police will co-operate with owners in every way, and cars will be permitted to stand in one position for an hour without objection. Much satisfaction was expressed with the report, since it was generally recognized that the provision of adequate parking spaces in the business district of a city is one of the most important points to secure in the development of the electric pleasure vehicle industry.

President Mansfield gave the results of a recent canvass of electric pleasure vehicles as follows: Indianapolis, 200; Buffalo, 450; St. Louis, 450; Cleveland, 1800; Chicago, 2400; Boston district, 144; Massachusetts, 370. In the last-named State there are now 24,946 gasoline pleasure cars. The possibilities of expansion are thus large. The committee on insurance submitted blanks for distribution to electric-vehicle owners, giving space for the recording of service, accident, damage and fire-loss statistics. Two of the largest insurance companies have informed Chairman Baker of the committee that if the claims of electric-vehicle advocates regarding safety and freedom from fire hazard are properly supported reductions in rates will be effected. There is no question that the electric-vehicle owner is now paying a share of the cost of insuring the gasoline car.

ADVERTISING IN RELATION TO THE ELECTRIC VEHICLE.

Mr. Gibbs discussed the fundamental principles of effective publicity and advertising writing in a trenchant manner, pointing out the importance of compelling attention in limited space, securing directness of appeal, forcefulness, originality and simplicity. He criticised repetition as weakening the influence of the argument, and laid considerable stress upon the value of suggestion. In advertising the electric pleasure vehicle the use of illustrations showing a handsomely dressed and attractive lady operating her own car is far more convincing than a bald admonition to use such a vehicle. Such a picture at once conveys a notion of comfort, luxury, cleanliness, elegance and that indefinable element denominated "class." Similarly, a view of an electric truck plowing through a snowdrift or moving steadily through the street laden with a burden which at once suggests the difficulty of handling such a tonnage successfully and economically by horses is more effective than mere generalities of expression. If tactfully used, the element of command may be effectively employed, as in the phrase: "Let the electric truck cut your delivery costs in two." In selling electric vehicles the advertiser must not forget that he is addressing a

busy man, and must avoid trying to tell the whole story in a single space reservation. The facts must be told simply, and the "peaks" emphasized. The employment of the advertising agency for specialized services was highly commended, and a wider use of the experience of newspaper advertising solicitors was advised.

The speaker said that the chief reason why the electric vehicle has not yet come into its own is the ignorance of the public regarding its reliability and economy. There are thousands of people who can afford to operate an electric vehicle if the apparent mystery of its service details is eliminated. The practice of the best garages more and more takes these details off the hands of the owner. Social emulation is an important factor in the selection of electric pleasure vehicles. The points which appear to tell most with the public are the features of cleanliness, healthfulness and scientific construction; by the latter meaning the care with which the vehicle has been put together.

In the discussion following Mr. Gibb's address the value of reading notices in papers printing vehicle advertisements was emphasized. The notice and the advertisement co-operate, but the notice must have human interest in order to be acceptable. Mr. Day Baker cited co-operative publicity which he had handled, even writing articles illustrating the machines of his competitors in order to promote the growth of the industry as a whole. Mr. J. F. McNalley, of the *Boston Herald,* urged the preparation of reading notices having genuine news interest, without the exploitation of individual makers' products. He emphasized the value of the non-cranking feature of the electric vehicle and pointed out the benefits of aggressive advertising. It was announced that, through the courtesy of Mr. Thomas A. Edison, moving-picture films were to be taken of the electric-vehicle parade to be held in Boston on May 30 in contrast with the work-horse parade. Closing, Mr. Gibbs spoke in disfavor of the comparative advertisement, with the exception of that which shows the limitations of the horse. It divides attention and tends to dignify the competitor too much. The policy of the Boston Edison Company has been to avoid any references to gas in its publicity work, in the belief that the day is coming when electricity will be in possession of the entire field of illumination.

New York Commission News.

Next week the Red Hook Light, Heat & Power Company and the Albany Southern Railroad Company will be heard on the applications for authority which will allow them to exercise franchises in Greenport, Columbia County. The Red Hook company seeks the assignment of a franchise which the town granted June 4, 1907, to Mr. Jonathan T. Rider, which has not been exercised. The company, which has a distributing plant at Red Hook, Dutchess County, and now serves Red Hook, Germantown, Livingston and Clermont with electricity, asks authority of the commission to enter Greenport. For some time past the Albany Southern Railroad Company has been furnishing electric energy for light, heat and motor purposes to residents of various towns along its railroad between Albany and Hudson. The franchise which it seeks to exercise was granted by the town board of Greenport on May 20, 1911. The terms of both franchises are practically identical in that they grant authority to the holders to construct necessary poles, lay pipes or install other fixtures for the conveying of electricity for public and private use for compensation.

The Red Hook company also asks authority to exercise a franchise granted to Mr. Jonathan T. Rider by the town of Claverack, Columbia County, for necessary construction for the furnishing of electricity for light, heat and motors in that town. It also seeks to enter the territory of the Albany Southern Railroad Company in the city of Hudson, and now has an application before the Hudson Common Council for a franchise to furnish electricity.

The Public Service Commission, Second District, has authorized the Syracuse Lighting Company to issue extension and improvement mortgage 6 per cent ten-year gold bonds to the aggregate amount of $456,000, the bonds to be sold at not less than 98. The proceeds of the bonds are to be used for general extensions and improvements in its gas and electric-lighting service in the city of Syracuse.

The Federal Telephone & Telegraph Company has been authorized to issue $578,000 of 5 per cent bonds upon the security of its mortgage dated March 24, 1909. Bonds to the amount of $364,800 par value may be issued from time to time for the purchase of the entire outstanding issue of bonds of the Niagara Home Telephone Company, amounting to $456,000, upon the express condition that for each and every bond of the Niagara Home Telephone Company so purchased and acquired there will be issued bonds of the Federal Telephone & Telegraph Company to the amount of 80 per cent only of the par value of the Niagara Home Telephone Company bonds, and upon the further condition that there shall be acquired presently from the Niagara company bonds to the amount of $275,000 par value. Bonds to the amount of $64,000 are allowed to be issued for the acquisition and purchase of the entire issued and outstanding capital stock of the Dunkirk Home Telephone Company, the exchange of bonds for stock to be par for par on the condition that there shall be acquired presently of this stock shares to the amount, par value, of $39,000. One hundred and fifty thousand dollars of bonds are to be issued for the purchase and acquisition of the property of the Independent Union Telephone Company, a long-distance line west of the city of Syracuse, including all property and rights of this company in the State of Pennsylvania. This latter purchase is authorized upon the express condition that at the time of the purchase and organization of the properties of the Independent Union Telephone Company and the issue of bonds therefor the Independent Union property shall be free and clear of all liens and incumbrances, etc., and that an absolute and unqualified title in fee be given to the Federal company.

The application of the Oneonta Light & Power Company and the Electric Water Power Company, of Oneonta, for permission to merge the latter company into the Oneonta Light & Power Company has been approved. The Electric Water Power Company was organized for the purpose of generating and distributing electricity, but afterward transferred all its property to the Oneonta Light & Power Company, which is the only company now operating for such service in the city of Oneonta.

The Public Service Commission, Second District, has closed upon its records the complaint of residents of Kingsbridge, Spuyten Duyvil and Riverside against the New York Telephone Company as to toll charges in the Kingsbridge and Marble Hill exchange territory in New York. The commission received a petition signed by practically all of the compainants indicating their satisfaction with an arrangement which had been made with the company and asking that the case be closed.

Wisconsin Commission News.

In the matter of the application of the Brooklyn Telephone Company for authority to increase its rates the Wisconsin Commission has decided that the present rates are adequate for the service now being rendered. The applicant, however, was empowered to put into effect the rates petitioned for at such time as it shall furnish continuous service to its patrons. The principal rates in force at present are as follows: Business telephones, $18 per year; residence telephones, $12 per year. The reasons stated for requesting an increase in rates are that the present rates do not produce sufficient revenue to furnish a depreciation fund, and that the furnishing of a continuous service, as contemplated in the future, will result in an increase of operating expenses. The testimony in the case shows that it has been the policy of the company to set aside a fund for de-

preciation and to utilize this fund for the purpose of making additions to the property. Furthermore, the company has been able to declare a 6 per cent dividend upon its capital stock practically ever since the company was organized. The commission usually allows a telephone company 7 per cent for interest and from 6.5 per cent to 7 per cent for depreciation. However, in the present case the commission was of the opinion that a substantial increase in rates is not justifiable as conditions are at present, but that the following schedule would be authorized at such time as the company offers continuous service: Business 'phones, $21 per year; residence 'phones, $15 per year.

The commission has authorized the Baraboo Gas & Electric Company to issue 1000 shares of stock of the par value of $100 each and $98,000 par value of bonds. The total issue is to be made to Messrs. Frank R. Glover, T. H. Durst and William Clancy on the completion of the organization of the Baraboo Gas & Electric Company to take all the property, rights and privileges of the Baraboo Electric Company which were acquired through a foreclosure sale. The total outstanding indebtedness of the latter company at the time of the foreclosure sale was $198,000. All of the outstanding bonds were owned by the incorporators of the Baraboo Gas & Electric Company. The commission has made no valuation, as the matter is one of reorganization only.

The Manitowoc Gas Company has been authorized to issue $2,500 par value of 5 per cent bonds for the purpose of paying 80 per cent of the cost of the enlargements and extensions of the company's property, for which payment the bonds are applicable under the terms of the trust deed, held by the Merchants' Loan & Trust Company of Chicago. The bonds are to be sold for money only and for not less than 75 per cent of the par value.

Testimony has been taken in the matter of the rates and practices of the Southern Wisconsin Power Company. This investigation has been carried on at the commission's own motion and concerns primarily the maximum loads which the company has arbitrarily assigned to the various cities and villages taking power from its transmission lines between Kilbourne City and Milwaukee. These arbitrary maximum loads constitute the basis upon which the demand charge is fixed, and there appears to be a doubt in the minds of the commission as to their equitableness.

Maryland Commission News.

The Maryland Public Service Commission has entered an order authorizing the Consolidated Gas, Electric Light & Power Company to issue 4½ per cent bonds to the amount of $844,000. Under the terms of the order the minimum price of the bonds is fixed at 92. The money to be derived from the sale of the securities will be used for the acquisition of new property and to discharge certain outstanding obligations of the company. The petition filed by the company states that $82,263 is needed for the Westport electric plant. Other large amounts are needed for substations, among them $79,565 for Arlington, while $60,000 will be used to refund bonds of the Brush and Edison companies that the present concern has bought out. The company also proposes to pay $262,000 of its floating debt out of the bond issue.

The Peters Wagon Works Company has filed a second complaint, asserting that the Consolidated company has demanded that the wagon company shall substitute direct for alternating current and remove its alternating-current motors at its own expense. The alternating current now in use is, it is claimed, especially well adapted to the business, and was substituted for the direct-current system which had been used until ten months ago. Willingness is expressed to have the direct-current system replaced, provided the Consolidated does the work at its own expense. The commission is requested to investigate the matter and order the lighting company either to supply the wagon works with new service or continue to furnish direct current.

Ohio Public Utility Bill.

The conference committee of the two houses of the Ohio Legislature has been hard at work during the recess on the preparation of a public utilities bill that will be acceptable to both, and early in the week the indications were that it will be ready for consideration when the session is resumed for the closing business.

In the agreement upon a basis for fixing rates the Wisconsin law was followed closely. Instead of the market value of the stocks and bonds being taken into consideration the actual property value will be taken as a basis, due regard being given to the necessity for the establishment of surplus, depreciation and contingency funds. Natural-gas and some other companies objected to this method and urged that companies should have a wide range in fixing rates, so that they might continue to do as they have in the past on the expiration of franchises.

In order to forestall the possibility of entering into contracts at a high rate for service that will be continuous because of their terms, the bill provides that the Public Utilities Commission may have power to terminate any contracts which are of themselves terminable. This, it is believed, will place all utilities entirely under the control of the commission in this respect.

Trouble was encountered in complying with the home-rule idea in making rates for utilities. Many of the cities have insisted that the Legislature must not take out of their hands the privilege of making contracts as to rates. In order to cooperate with the municipalities a majority of the members of the committee are in favor of leaving the matter with them, subject to an appeal to the commission by either party.

The bill will declare telephone companies common carriers, and all consolidations will be placed under the control of the commission, which will be absolute in the matter of agreements, contracts, leases and other forms of combination. Physical connections must be made between localities, but not within municipalities, except for long-distance purposes. This provision is so formed because of the belief that each municipality will have but one exchange within a short time after the law goes into effect.

The commission will have power to require joint use of poles, wires, tracks and other equipment within a municipality when necessary to the public convenience, on condition that such requirement does not work an irreparable injury to the company upon which such demand is made.

Companies furnishing a continuous service may establish a minimum rate. This provision is especially applicable to gas and electric-light companies, and was inserted as a kind of compromise with the gas companies, which had insisted upon many things they did not get. Members believe that some charge should be made for being in position at all times to furnish a service, even if the service is not used for certain periods or is used to such a slight extent that the rate will not cover the expense of maintaining the equipment.

Massachusetts Legislative News.

The committees on railroads and metropolitan affairs, sitting jointly, have reported a bill in favor of the Boston & Eastern Electric Railroad Company, declaring that public necessity and convenience require the construction of the road. The act also provides that it shall become void unless the company files a bond for $100,000 within thirty days, and within 160 days the Railroad Commission must be petitioned to fix the detailed route. An alternative is provided that within sixty days the company shall file a bond for $400,000 with the State so conditioned that upon the beginning of the work at least 10 per cent of the capital stock shall be expended. In case of the default of the company the bonds will be forfeited to the State. Upon meeting the conditions of either of the bonds the directors may be reimbursed by certification of the Railroad Commission.

New Hampshire Public-Utilities Law.

The new public-utilities law of New Hampshire, which was approved by Governor Bass on April 15, contains a number of unusual provisions.

No person who owns stock in any railroad in the State or elsewhere, or in any utility in the State, or who is employed by any such company, or otherwise pecuniarily interested therein, shall be appointed upon the Public Service Commission. If any commissioner shall become voluntarily interested pecuniarily in any such company he shall be removed as for malfeasance in office, and if he shall become so interested otherwise than voluntarily and shall not within a reasonable time divest himself of such interest he shall be so removed. The Governor and Council may remove any commissioner for inefficiency, neglect of duty or malfeasance in office after a hearing.

No commissioner shall render any professional service for any railroad in New Hampshire or any other state, or for any public utility in the State, or act as attorney, or render professional services against any such company, or be a member of a firm rendering any such service, nor shall he be a party to any contract with any such company, except for the transportation of telephone or telegraph messages, or passengers or property, or the purchase of water, gas or electricity, or other similar service. No commissioner shall hold any national or other State office of profit except the office of justice of the peace or notary public.

Witnesses summoned before the commission shall be paid on the same basis as witnesses summoned before the Superior Court. Any witness who refuses or neglects to appear, or refuses to testify, may be compelled to do so and for that purpose the commission may apply to any justice of the Superior Court for an order returnable in not more than five days directing the person to show cause why he should not be committed as for contempt. If the justice shall determine that the person refused without reasonable cause or legal excuse he may commit the offender as for contempt, so to remain until he submits to do the act which he was required to do or is discharged according to law. No person shall be excused from testifying or producing any book or paper when ordered to do so by the commission upon the ground that his act would incriminate him or subject him to penalty or forfeiture, but no person shall be prosecuted for any act concerning which, after claiming his privilege, he shall by order of the commission have testified or produced evidence. It is provided, however, that no person shall be exempt from prosecution or punishment for perjury in testimony.

The new commission assumed charge on June 1, 1911, of the powers and duties of the present Board of Railroad Commissioners. The commission is to have general supervision of all utilities so far as necessary to carry into effect the provisions of the act. It is to have power to investigate and ascertain from time to time the methods employed in manufacturing or supplying electricity for light, heat and power, and after notice and hearing to order all just and reasonable improvements and extensions in service or methods.

Whenever it deems it advisable the commission may establish a system of accounts and records for public utilities, and prescribe the manner in which the accounts shall be kept. Every utility shall file and print and keep open for public inspection schedules of rates in such places, form and detail as the commission may order. Unless the commission orders otherwise, no change shall be made in rates except after thirty days' notice to the commission and such notice to the public as the commission shall direct. Whenever any schedule of higher rates shall be filed the commission may investigate the reasonableness of the proposed changes, and pending such investigation may suspend the schedule for such period not to exceed six months as in its judgment may be necessary.

If any utility neglects to file a report within the time specified by the commission or to make specific answer to any question lawfully asked $100 shall be forfeited for each day of default. The commission of its own motion may investigate any act done or omitted to be done by any utility, and shall make such inquiry in regard to any act done or omitted to be done in violation of any provision of the law or order of the commission.

No utility shall transfer or lease its franchise, works or system, or any part thereof, to any other person or corporation, or contract for the operation of its works and system, until the commission shall give its assent thereto by order. No utility shall directly or indirectly acquire the stock or bonds of any other corporation incorporated in or doing business in the State, and engaged or preparing to engage in the same or similar business, unless so authorized by the commission. Nothing in the act shall prevent a utility which is the owner at the time of the passage of the act of the majority of the stock of any other utility or is licensed to operate such other utility from acquiring the balance or all of the outstanding stock of the other utility. Every contract for transfer of any stock in violation of this section shall be void.

Whenever it is necessary to construct a line, extension, etc., over the land of any other person or corporation, or it is necessary for a utility to acquire land for a necessary extension, and an agreement cannot be reached with the owners as to the necessity or the price to be paid, the utility may petition the commission for rights and easements or permission to take such lands as may be needed, and the commission thereupon shall determine the necessity and the compensation and shall render judgment accordingly. Any person aggrieved by an order of the commission awarding damages may file a petition in the Superior Court and have the damages assessed by a jury.

No utility shall issue stock, bonds, notes or other evidences of indebtedness payable in more than twelve months after date without first procuring an order of the commission. The commission upon petition shall determine the amount of stock or bonds reasonably requisite for the purpose. No utility shall apply the proceeds of such issue to any other purposes than those specified in the order. Accounts showing in such detail as the commission requires the disposition of the proceeds shall be filed.

Whenever a utility shall increase its stock it shall offer the new shares proportionately to its stockholders at such price, not less than par, as shall have been determined in the vote for the issue. The determination by the commission of the amount of stock reasonably requisite shall be based upon the price at which the stock is offered to stockholders. The commission shall refuse to authorize any particular issue if in its opinion the price fixed is so low as to be inconsistent with the public interests. When an increase in stock does not exceed 4 per cent of the existing stock the directors, without first offering it to the shareholders, may sell the new shares by public auction at not less than par for cash.

Whenever the commission shall be of the opinion that a utility is failing to do or is about to fail to do anything required by law or by order of the commission, it shall have authority to lay the facts before the Attorney General and to direct him immediately to begin action in the name of the State praying for relief by mandamus or injunction or otherwise.

Any order of the Superior Court suspending an order of the commission reducing rates shall provide that the utility affected shall keep such accounts as shall show the amount collected in excess of that amount which it would have received if the order had not been suspended, and that any such excess shall be impounded within the State or paid into court. Whenever there is occasion after final decision for the distribution of said excess, any violation of the order of the court providing for the repayment of the excess may be punished as a contempt of court. In all trials, actions and proceedings growing out of the authority granted to the commission the burden of proof shall be upon the party adverse to the commission or seeking to set aside its determination or order to show by clear and satisfactory evidence that the order is unreasonable or unlawful.

REPORT OF THE NEW YORK CONVENTION OF THE N. E. L. A.

President Freeman's N. E. L. A. Address.

IN his address before the National Electric Light convention President W. W. Freeman reviewed in detail the work of that body during the past year. During that period 3500 members were added, making the present total membership more than 8500, and President Freeman stated his belief that there is nothing to prevent continued growth at a rapid rate for several years to a membership of perhaps 25,000. He pointed out that as the complexion of the organization changes new methods of procedure must necessarily follow. Opinions differ as to the urgency or desirability of radical changes, but all agree that in the natural evolution of the organization there may arise an imperative need for changes which it is not too soon to anticipate and carefully consider. With individual membership added in blocks of thousands, each having a direct interest in all that the association does, the problem of meeting *en masse* annually increases. Unquestionably there is inspiration in a large meeting, but there is a certain disadvantage in the loss of individuality and free discussion such as is possible only in smaller meetings. The holding of frequent parallel sessions between general sessions offers some solution for the time being, but these meetings, in turn may become unwieldy. As the geographical sections multiply in number and in activity it is probable that the conventions of these sections can cover satisfactorily much of the important educational work now being performed by the national organization and at less inconvenience and expense to the local companies. It has been seriously suggested that ultimately, and perhaps shortly, the national convention should be limited to a given number of representatives of the member companies to discuss particular questions of policy and issues of common interest without reference to details of engineering and commercial practice, which subjects could then be treated in the conventions of the geographical or other sections. On the other hand, the policy of national special sections has been urged for the standardization and exchange of principles and experiences concerning special lines of work, such as the present Commercial and Power Transmission Sections, it being pointed out that geographical sections are generally too restricted to furnish comparative experiences to both the large and small companies.

It is probable, President Freeman stated, that neither the one nor the other plan would alone meet the situation fully, and, under the authorization of the constitution, both ideas are in operation and working toward an ultimate solution of the problem. Referring to company sections President Freeman said that experience has shown that the company-section idea has proved sound and successful wherever it has been given a fair trial, and the great growth of membership in such sections has clearly demonstrated their desirability and permanent usefulness. The provision for geographical sections is also steadily growing in favor. The division of membership into geographical sections is the logical method of sub-organization for much of the work of the association. The existence of separate state associations is an evidence of the need for territorial organization, but since many if not practically all the member companies of such associations are already members of the national body the separate organizations generally involve additional and unnecessary effort and expense. The plan is to consolidate effort in the one general organization, having such subdivision as may be necessary or wise, and thereby meet all needs, whether local, geographical or national, at a minimum of expense and effort and with a maximum of efficiency and influence.

Reference is made to the national special sections of the association now organized, namely, the Commercial Section and the Power Transmission Section. The latter, President Freeman stated, has made its influence felt in the discussion of public questions of special importance to the central-station industry, notably in the public conference held in New York on April 8. There is reason to believe that the national administration and Congress will welcome reliable information bearing upon the proper utilization of water-powers, and President Freeman believes it to be the duty of the association to facilitate in any proper way the adoption by the national government of a policy of conservation which shall be reasonable and economically sound.

Referring to the report of the public-policy committee, President Freeman said that its group of welfare policies will place the association in the forefront of modern industrial advance. In addition to preparing its report, the committee, he said, had given attention to numerous matters of policy which have arisen during the year.

In referring to the work of the accounting committee, its classification of accounts was praised. President Freeman said that the value of the system of accounting which it had formulated had been recognized through its adoption not only by many central-station companies, but by certain of the public-service commissions. The member companies were urged to take full advantage of the standard system which had been devised, especially since the general adoption of such a standard by the lighting companies will continue to be influential in obtaining its adoption by commissions and regulating bodies throughout the country.

In conclusion President Freeman said that probably no other industry has equaled that of electric lighting in attracting so many men of talent and enterprise, and in imbuing them with the conviction that theirs is the best business in the world and holds out the largest opportunities for advancement and reward. Great as has been the history of the first quarter century of the business, he believes that the industry has only been started and that past achievements are but the promise of future accomplishments. The business is one of action and growth, and the man who stands still in it is certain to be left behind as the procession moves, whereas the man who studies and works and advances can find new roads to success and ample help on the way.

RELATIONS OF CENTRAL-STATION COMPANIES WITH THEIR EMPLOYEES.

REPORT OF THE N. E. L. A. POLICY COMMITTEE AND ITS DISCUSSION

TO say that the presentation of the report of the public-policy commission of the National Electric Light Association and its discussion at a special meeting in the New Theater on Wednesday evening constituted the leading event of the New York convention does not imply any lack of strength in the other entries on the program of the week. The program of the meeting was, in fact, better balanced and the papers, on the whole, of greater intrinsic worth than at any previous convention in the history of the body. But the report of the committee on policy dealing with relations of central-station companies with their employees exhibited such breadth of view and liberality of spirit as to constitute it a document of national importance which promises to have an influence extending far beyond the industry to which its recommendations directly relate.

The committee which prepared the report consisted of the following members of the association: Mr. Charles I. Edgar, president of the Boston Edison Company, chairman; Mr. Arthur Williams, general inspector of the New York Edison Company, secretary, and Messrs. Nicholas Brady, vice-president New York Edison Company; Everett W. Burdett, counsel Boston Edison Company; H. M. Byllesby, H. M. Byllesby & Company, Chicago; Henry L. Doherty, H. L. Doherty & Company, New York; W. W. Freeman, president National Electric Light Association and vice-president Brooklyn Edison Company; Gen. George H. Harries, vice-president Washington Railway & Electric Company; Samuel Insull, president Chicago Commonwealth Edison Company; Joseph B. McCall, president Philadelphia Electric Company; Samuel Scovil, president Cleveland Electric Illuminating Company; Charles A. Stone, Stone & Webster, Boston. At the special request of the committee, the following gentlemen attended and assisted at the meetings of the committee: Messrs. H. W. Blood, Jr., Stone & Webster, Boston (representing Mr. Charles A. Stone); R. S. Hale, Boston, Edison Company; Thomas E. Murray, president Association of Edison Illuminating Companies and second vice-president New York Edison Company.

Following is given the report, slightly condensed, and a report of its discussion at the special meeting in the New Theater before an audience of more than 3000.

In opening its report the committee says that undoubtedly modern industry on a large scale depends upon three factors, namely, capital, direction—executive and administrative—and labor. All combined and working in harmony are so essential that a partial or dwarfed interest in any one factor would invite absolute failure, or at best make possible only partial success. However, neither the interest of capital nor that of direction has been considered by the committee, excepting in so far as either is conserved by an equitable interest in the welfare of labor. Nor has it been attempted to pass upon the question of wages, other than to express the belief that in the same locality they should be fully equal to those paid by any other employer engaged in similar work. Wages are a local and independent question and in this respect, so far as the committee's knowledge goes, the employees of the industry are treated very generously. The work of the committee has rather dealt with questions such as follow:

(*a*) Are employees, individually or collectively, receiving all of the results of their labor to which they may be properly entitled?

(*b*) Are they adequately compensated in the event of industrial sickness or accident? Do we appreciate and fairly assume the responsibility—moral if not technical—sometimes resting upon us to restore an injured employee to health, or in the event of a fatal accident to provide adequately for his dependents?

(*c*) Do we take sufficient interest in the welfare of our employees when, owing to conditions beyond their control, such as serious sickness, they are in distress and possibly subject to want and deprivation?

(*d*) Are there any available means other than those now employed by which the efficiency of labor can be fairly increased?

(*e*) Can the differences between labor and capital be lessened or removed without decreasing the efficiency of labor?

ECONOMY AND HUMANITY.

Believing that anything accomplished in the solution of these questions possesses elements of sound economy as well as of humanity, the committee realized that its conclusions may not apply with equal appropriateness to all members. It is mindful that differences may exist in different communities, not alone regarding financial resources and the personality of the employees, but in public sentiment. What one may find practicable and profitable, another—equally anxious to accord fairest treatment, and no less mindful of public interest—may find impracticable or impossible of accomplishment.

Upon these questions wide differences of opinion naturally exist. This was originally true in the committee, but consultation with various authorities, consideration of available statistics and the experience of others have enabled it to reach a common and unanimous conclusion. The adoption of the suggestions of the report thus must depend upon the judgment of members individually.

SERVICE ANNUITY.

By unanimous vote the term "pension," as being inadequate or subject to wrong interpretation, has been eliminated and the term "service annuity" recommended as a substitute. The opinion of the committee is that the latter is to be paid as a form of compensation for a definite service that cannot be rightly included within ordinary wages. It is compensation for continuous service over a period of several years and is to be paid upon carefully prearranged and understood conditions.

WAGES.

As employed in the report the term "wages" is inclusive of both wages and salaries, for in the last analysis the latter is also a wage for a given service. Wages are the sum paid for a given work and should be the same in a corporation whose relations with its employees go far beyond any legal requirements, or with one which does nothing more than meet its technical obligations, or with a private employer. Any contribution for the improvement of an employee's surroundings or of himself should not be construed as affecting his wage in the slightest degree.

NEITHER CHARITY NOR PHILANTHROPY.

The committee felt it important that all suggestion of charity or philanthropy should be entirely eliminated in the establishment of relations between employees and their employers. It is urged that these several forms of relationship be adopted in the sense that the employees are to get only that which they earn, that what they receive is the result of rendering service as well as of performing work—oftentimes two entirely different phases of industrial employment.

Were a word of explanation needed it might be pointed out that an employee performs his technical task for a definite wage; in addition he can, and often does, render his employer service by working continuously and in exercising a degree of devotion which affects not only his own work, but that of all other employees associated with him. Thus in continuous service, with other advantages, we have enhanced efficiency; with increased devotion to his employer "soldiering" becomes lessened or eliminated; in a more careful utilization of tools and materials still other economies and efficiency may be expected.

It is to secure this added service that the committee has endeavored to find a form of compensation reasonable and mutually satisfactory. This it believes has been accomplished in the recommendations of its report. Further, that in this (*a*) there will be inevitably larger resultant efficiency and economy, though not necessarily apparent statistically, and (*b*) that expenditures devoted to these purposes are justified as elements in the cost of service, and would be so considered by legislative authorities, public-service commissions or others passing authoritatively upon the subject.

The suggested forms of relationship include (1) accident insurance, (2) sickness insurance and death benefits, (3) service annuities, (4) profit sharing, (5) employees' savings and investment funds, and (6) life insurance.

ACCIDENT INSURANCE.

The committee believes that the cost of all accidents inherent to the industry which it represents should fall, not upon the individual employe or his dependents, but upon the industry as a whole. It, therefore, recommends:

(*a*) That when an accident occurs which is clearly without deliberate misconduct, gross carelessness or reckless disregard of consequences on the part of the employee, the entire cost should be borne by his employer, who should assume full responsibility for restoring the injured employee to health as rapidly as possible.

(*b*) That full wages should be continued during illness and convalescence for a period of six months, and at the expiration of six months the wages should be continued at one-half the full wages for life or during disability, unless the "service annuity" to which the employee would be entitled in case of retirement should exceed one-half the wages, in which case the employee would be entitled to the "service annuity."

(*c*) That in the event of partial disability proportional payments should be made to compensate, either wholly or partly, for the employee's decreased earning capacity, if there be any.

(*d*) That in the event of death from accident within the service, the payment to which the employee would be entitled in the event of total disability shall be continued: (1) To his dependents, should there be any, during the employee's expectation of life, under the assumptions of the "American Experience Table of Mortality," or (2) until a widow should again marry, or dependent children reach the age of sixteen years, or to other dependents, such as a father or mother, while they live, with such other provisions as may be applicable in individual cases, but in no event to exceed the deceased's expectation of life under the experience table.

SICKNESS INSURANCE AND DEATH BENEFITS.

This is a kind of relationship which has no connection with industrial accidents or industrial sickness; of the latter, however, there is practically none in the central-station industry. Many members have established associations of this character, and where such organizations do not exist the committee believes it desirable:

(*a*) To organize and, subject to local conditions, to contribute where necessary to employees' co-operative benefit associations.

(*b*) To encourage their harmonious and successful development in every practical way.

(*c*) It is estimated that, assisted by the employing company, co-operative associations can contribute approximately 50 per cent of the employee's wages when sick at a cost of approximately 1 per cent of his wages. Likewise, that a death benefit of from $300 to $500 can be paid with a weekly contribution ranging from 10 cents to 15 cents.

In this the committee omits all detail, realizing that members have had a great deal of experience and believing that it is better for these associations to be organized and conducted, so far as practicable, by the employees in co-operation with the company and the policy that guides its affairs.

SERVICE ANNUITIES.

The committee is of the opinion that member companies should provide a "service annuity" for every permanent male employee who reaches the age of sixty-five years, and for every female employee of sixty years having a continuous and satisfactory record of ten years of service. In this connection the following recommendations are offered:

(*a*) That the entire cost of "service annuity" should be contributed by the company as part of the annual cost of labor.

(*b*) That this is to be the compensation to which the employe is entitled, in addition to his wages, for rendering continuous and satisfactory service throughout his term of employment.

(*c*) Should the continuity of the term be broken by the employee of his own volition the obligation to pay the "service annuity" would cease. The term, both in reference to the minimum period at which the "service annuity" can begin and the percentage upon which the amount shall be based, must then begin with renewed or reinstated service.

(*d*) The possible exception to this rule is where employees are laid off temporarily through no fault of their own. The committee suggests that if this is done by the company an employee's service, when not less than nine months yearly, shall be treated additively in determining the "service annuity." Likewise it is suggested that if employees are temporarily laid off because, say, of the destruction of the power plant or for similar cause, this should not be considered as an interruption in the continuity of service. The point is emphasized that the service of the employee is discontinued through no fault of his own, but for economic reasons within the company.

(*e*) That any employee having a minimum record of ten years of continuous and satisfactory service, and who in the opinion of the company has become unfitted for duty, may be retired at any age and given a service annuity; that any such employee may make application for retirement or that the recommendation may be made by his employing officer.

(*f*) The suggested basis of service annuities is from 1 per cent to 2 per cent of the yearly wages, as may be adopted by the company, for each year of continuous service, based upon the employee's wages during the highest ten consecutive years of employment.

PROFIT SHARING.

The adoption of the principle of profit sharing by members insures a means for establishing closer, more efficient and more satisfactory relations with employees. The following suggestions are offered:

(*a*) That the justification for profit sharing is to secure and pay for service of fidelity and efficiency.

(*b*) That the object is to secure partner instead of employee service, to have our fellow workers partners instead of employees in the accepted sense of the term.

(*c*) That the compensation paid to employees in the form of profit sharing should be considered no part of the ordinary wage schedule.

(*d*) That ordinarily profit sharing should preferably not be paid immediately in cash. Local conditions may control this general rule, and at times special reasons may make payments in cash desirable, as, for example: (1) The purchase of a home. (2) Special circumstances which, in the judgment of those in control of the matter, justify cash payments.

(*e*) That preferably the profits of the employee should reach him in the securities of the company, or, in the case of a subordinate company, the securities of the parent company.

(*f*) That securities for distribution in other than special instances should be secured at the best terms and wherever obtainable. Employee security holders would necessarily bear any reduction and receive the benefit of any advance in values or the rate of income paid.

(*g*) That dividends upon securities acquired through profit sharing should be paid in cash in the manner customary to other security holders and available for any purpose desired by the recipient.

(*h*) The committee emphasizes that one object of profit sharing is to have every employee also an owner. If he does not receive securities this ownership interest may not follow, or if after receiving the securities he sells them his lasting interest is not secured.

(*i*) The committee recognizes that this feature of its plan calls for the largest contribution required in this movement; on the other hand, the economic results promise to be most important and satisfactory in (1) more efficient and permanent service; (2) a tendency greatly to improve the relations between the companies and their employees; (3) the creation of a large number of security holders from the body of employees who will thus have a double interest in the welfare and success of the property.

(*j*) In the distribution of the results of profit sharing the committee desires impartially to suggest two plans, leaving the adoption of either to the judgment of the individual member: (1) Restricting the sharing of profits to employees who, in the judgment of those to whom they are subordinate, render specially efficient service. This means that those who are to become participants in profit sharing must be carefully selected from year to year from the employee forces. (2) Sharing profits alike with all employees having a minimum period of service, say of one or two full calendar years, excepting under very special circumstances.

(*k*) Some favor giving at once the maximum amount to all who are entitled to it, others favor increasing the amount with the service, giving the maximum only after several years have elapsed. The latter method places an added premium

upon long service, but between the two methods the committee makes no recommendation, believing that this is a local matter.

(*l*) The committee believes that in sharing profits with employees a dividend should be declared annually which bears a fair relation to the income paid to the security holders, and also that there should be definite relation between the securities and the labor dividend.

EMPLOYEES' SAVINGS AND INVESTMENT FUNDS.

It is evident to the committee that in view of the experience of some of the member companies a material benefit can be obtained by establishing employees' savings and investment funds. Possibly this should be divided into two classes. The first would be simply a savings fund to encourage thrift among employees, under which the deposits would be guaranteed by the company and more than the ordinary savings-bank rates of interest could usually be paid.

SAVING FUNDS.

For savings funds the committee makes the following recommendations:

(*a*) That the security and safe return of the funds be guaranteed by the company.

(*b*) That every convenience be afforded employees to make their deposits.

(*c*) That deposits be made directly by the employee rather than that the company, under other than special conditions, take them from his wages.

(*d*) That to encourage thrift where deposits are permitted to remain for a definite period the company might guarantee something more than the savings-bank rate of interest; that where left for less than a definite period they may be withdrawn under substantially the conditions that apply to savings-bank deposits.

INVESTMENT FUNDS.

The second suggestion is that an investment fund for the employees might be organized with the understanding that the funds shall be invested only in the company's securities. This might be combined with profit sharing and the two work very satisfactorily together. For an employees' investment fund the recommendations are as follows:

(*a*) That the company should assume full responsibility for receiving and accounting for the funds.

(*b*) That the responsibility for the investment of these funds should rest solely upon the trustees and members of the investment fund.

(*c*) That the securities of the fund should be purchased at the best prices obtainable.

(*d*) That the members should understand that the result of their investment might be either a profit or a loss, exactly as these possibilities rest upon every other investor in public-service securities.

(*e*) That every convenience should be afforded for receiving the deposits of the members of the investment fund. The committee thinks it undesirable for the company to make deductions from its employees' wages, excepting under other than very special circumstances; rather should the money be paid directly by the employee to the accredited fiscal officer of the investment fund.

LIFE INSURANCE.

It is s ggested that members take the initiative in providing their employees with all possible information in connection with safe low-cost life insurance, but that such insurance should be at the sole cost of the employees.

IN CONCLUSION.

The committee in concluding recommends that any plan adopted for improving the relations between employees and member companies shall include every employee and officer from the office boy to the president, inclusive. It is added that several of the members of the association have already adopted some of the recommendations of the report, and that should any information be desired upon the methods followed or the results accomplished, the secretary of the association will be glad, upon request, to furnish any information in his possession.

PRESENTATION OF THE REPORT.

The report of the public-policy committee was considered in executive session by the association on Wednesday and adopted. It was formally presented to a notable gathering at the New Theater on the evening of that day and was received with evident great interest as a manifestation of that spirit of progress which has made the association and the industry famous.

The circumstances under which the report was given its public expression were in complete accord with the importance and the strength of the recommendations advanced. It was to an audience that was representative of the power of the industry that President W. W. Freeman introduced the subject as the first spokesman of the association. A number of people were present at the beginning of the musical program which preceded the business of the evening, and the seats were filled rapidly until, as Mr. Freeman said, it was a question whether so large an assemblage composed entirely of the membership of the association had been seen before.

In his pleasing introduction Mr. Freeman, speaking for the members of the committee and other leaders of the industry who were on the platform, said that it was very gratifying to greet so large an audience under the inclement weather conditions of the evening. The attendance indicated a keen appreciation of the importance of the subject as well as of the distinction of the speakers of the evening. The subject is presented from the viewpoint of the industry and from the larger point of view of the national welfare. This association does not hesitate to express its views on all questions relating to its employees and the public. It is proud of the business in which it is engaged and proud of its past record. It proposes to put itself on record in a way that shall be commensurate with the record of the past and that shall point to corresponding responsibilities and growth in the future.

The means of communication of the views of the association on these subjects is through the public-policy committee, which is composed of men known throughout the industry and the country and who have the entire allegiance of the membership. The committee has done continuous and invaluable work during the year. It is composed of men who know how to do big things and have the courage of their convictions. This year the committee determined to undertake to do but one thing, and to do that thoroughly. Mr. Freeman added that he was sure that the members of the association would agree that the committee had succeeded in its task. The meetings held by the committee during the year were numerous and extensive in time.

The question may be asked, Mr. Freeman continued, why busy men are willing to devote so much time to matters that are of more interest to the general public than to themselves. The answer is that the industry should take a prominent part in any movement that tends to advance the public welfare. The committee gathered all the information that it could secure upon general welfare work. Its members obtained data and compared results and the committee was prepared to submit detailed and unanimous recommendations which, if followed, should and would place the industry in advance of all others in the country in carrying out reasonable and definite welfare work. The chairman of the committee, Mr. Charles L. Edgar, is abroad on a well-earned vacation, and Mr. Arthur Williams, the vice-chairman, secured the consent of a member of the committee to present the report; a member, said Mr. Freeman, who was greatly interested in the association and in the progress of the work during the year, and whose name would be an introduction to the audience—Mr. Samuel Insull.

Mr. Insull read the report in full, as published elsewhere in these columns. He then supplemented the report by a personal positive recommendation for the adoption of the measures advanced by the committee, showing most skillfully and successfully the intimate connection between the text of the report and

other problems of the day. Mr. Insull's remarks are published substantially in full below.

When Mr. Insull concluded Mr. Freeman stated that the report had the added influence of formal adoption by the association. It is now given to the public, therefore, as the expression of the association.

Mr. Freeman announced that he and General Harries discussed these questions recently with President Taft, who showed much sympathetic interest in the subject. President Taft was invited to honor the convention with his presence. The extra session of Congress made it impossible for the President to accept, but the Hon. Charles Nagel, Secretary of the Department of Commerce and Labor, was present at considerable personal sacrifice. Mr. Freeman congratulated the audience upon the presence of Hon. George B. Cortelyou, and then introduced Secretary Nagel. Upon the conclusion of Secretary Nagel's address, which is published elsewhere in these columns, President Freeman stated that the recommendations of the committee had been determined by experience to be practical and that every company ought to make at least a start in a welfare policy.

The meeting was then closed.

REMARKS OF MR. INSULL UPON THE PUBLIC-POLICY REPORT.

The only discussion upon the report of the public-policy committee of the National Electric Light Association was contained in the remarks with which Mr. Samuel Insull gave additional emphasis to the recommendations and in the introductory and supplemental remarks of President Freeman.

After concluding his presentation of the report of the committee, Mr. Insull said that, while a number of the members of the association have done considerable in the direction of welfare work, it is perfectly natural that in a business which has grown in a little less than three decades to the enormous proportions which the electric light and power business of to-day shows attention should have been devoted for a number of years more especially to matters of new invention, improvements in efficiency of apparatus, and improvements in the method of conducting our business. But notwithstanding all of the effort that has been bestowed on these various subjects, the financial results, that is to say, the dollars and cents, have really gone to the consumers of electricity throughout the country, to the extent of probably between 90 and 95 per cent of the money that it has been possible to save by these improvements.

The questions of relations to the public and to the communities served and the view taken of the companies by their customers are subjects to which a great deal of attention has been given in the past, and will be given in the future, but Mr. Insull said he knows of no subject that will bring a greater money return than attention to the welfare of employees. Those in the room appreciated the fact that one of the greatest pleasures that can possibly be afforded to men who have the responsibility of directing large enterprises is not the pleasure afforded by the money which they can make for their stockholders, but the pleasure that is afforded to them to do good to their fellows, and to try to leave the world a little better off than when they came into it.

While the sentimental side of this work is very inviting, there is another side of it which has to be considered. As the business is one of monopoly, it has to be operated economically to meet the best interests of the users of service, and such methods must be adopted as will enable them to get the service rendered for the least possible price. If the business is to be operated with due regard to a safe return on capital, it must be run as a monopoly business. In welfare work with employees, consideration must be given to the fact that as the business is a monopoly business companies are subject to regulation of rates. That regulation may come in the shape of action by the Board of Aldermen, or by a State commission, or from legislators having the power to deal with such matters, or in the shape of an appeal to the courts on a charge of the unreasonableness of rates; and the real, final test of this welfare work will come when it is proposed to include all or most of the matters treated in the report in the cost of service. The cost of the selling price to customers will have to be passed upon by whatever regulating bodies may have jurisdiction.

Continuing, Mr. Insull said he knows of no business where continuity of service is of such great importance as in the central-station industry. It is a business of very great capitalization, in proportion to the yearly turnover. It is impossible to run it satisfactorily so as to turn over the cash capital more than once in five years. There are very few instances on either side of the Atlantic Ocean where such a result has been obtained. The consequence is that the interest and the depreciation accounts are of far greater importance than the wage account, and what is needed, in order to keep down the interest and depreciation accounts, is absolute continuous and faithful service. That can only be obtained by the offer of some incentive beyond the mere wage to which every laborer and every man who works with his hands or brain is entitled.

The subjects with which the report deals are not exclusively association subjects. The industry is not alone in this work. Most of the great industrial corporations in this country are giving a great deal of thought and attention to these matters to-day, and as a result aid very substantially in the welfare work in connection with their business, largely for the reason set forth in this report, and the reasons stated in these remarks. In other countries, a great deal is being done in the direction of governmental assistance and legislative action. Take, for instance, the drastic employees' liability law passed in England, or the old-age pension bills passed in England and Germany, or the compulsory insurance measure with all its complex details as proposed by the British Chancellor of the Exchequer. These are examples of a species of governmental paternalism, certainly with relation to the old-age pensions and compulsory insurance, which could hardly find any favor in this country. It appears to the public-policy committee that it is far better that that work in this country should be done voluntarily, based upon the mutual interests alike of the consumer, the employee and the capital invested. That is the work that it is hoped to start among those who have not taken up the subject. It is not necessary in every case to carry out all the plans suggested in this report. That is not a possibility in a great many cases. It is possible for every one, although it is not possible for all to try all of these schemes, to apply to his own case one of these schemes, or some other scheme. If this is done it will improve relations with the employees. Mr. Insull concluded by saying that he was confident that this would improve relations with the public, and would add to the stability of the securities of the business.

ADDRESS OF SECRETARY NAGEL ON THE PUBLIC-POLICY REPORT.

Secretary Nagel stated that after listening to the report of the public policy committee he accepted the invitation to speak as a double compliment. He represents a department with a very long name—commerce and labor. He is disposed to lay particular stress upon the word "and" in that title, because he believes that the more closely commerce and labor can be associated and made of mutual advantage, the better off this country will be. He is the beneficiary of the work that was done by Mr. Cortelyou in laying a foundation for that department. There is not a day in which he does not find the results of Mr. Cortelyou's labors when that foundation was laid, and he is doing the best he can to pursue it in that spirit and to develop the vast interests represented by it harmoniously with each other.

The national government sustains no immediate relation to the question under consideration, certainly not so immediate a relation as some may suppose. The department has to do largely with the making of investigations and with reports, in the hope that the knowledge which is thus distributed may be gradually accepted by the states to shape legislation and their course and may be accepted, indeed, by private and quasi-public organizations for their guidance.

After listening to the report Secretary Nagel said he was encouraged to believe that in many respects it will be possible to do without the co-operation of the state authorities and to rely upon the best motive power for any community, namely, private initiative and enterprise, for mutual well-being.

The country has been tardy in recognizing the dangers that have lurked in the situation with which the association now has to deal. We have permitted ourselves to believe that everything must come to us and that we need not grapple with the social and economic problems that have disturbed other countries. We permitted the old doctrines to rule and rejoiced in our prosperity until a condition of things arose that no fair-minded man could tolerate. Take any one of the subjects to which reference has been had and it will be recognized at once that the positions are not acceptable to an enlightened man. Take the mere case of accident. Every business man, every honest lawyer, knows that we have permitted old rules to prevail that did not meet enlightened modern standards. Our courts were crowded with damage suits and we were wrestling and fighting with antiquated doctrines to the injustice and the injury of men who deserved a better protection.

Secretary Nagel added that he did not believe in overlegislation, but he believed that when there is complaint the best way to cure it is to take the sting out of it. Too tardy recognition of demand for normal improvement had been the greatest breeder of radical legislation. There were men who recognized this; there were interests that recognized this; there were large employers who were making changes; there were large concerns that never had damage suits. For twelve or fifteen years, one that employed from 3000 to 4000 men never had a damage suit, and made money for the employees and for itself. That stood to reason. There were larger concerns that were adopting modern methods, based upon the mutual interest of employer and employees. But they were not noticed. The courts were crowded with the old litigation, according to the old crude forms, and that was the feature that attracted attention. Much was heard about publicity; but the trouble about publicity is that it gives a distorted picture. We are not half so bad as we are made out to be. The Secretary believes in being sanguine and hopeful, and thinks that we are a pretty good people as we are. But vice is apt to find notoriety and virtue is not a good advertiser.

So with all the changes that were coming over us, with all the improvements that men were making; the demand for the modification of our laws was becoming more and more evident. We changed the law in some states as to contributory negligence. We changed the law in other states as to co-employees, and so we went forward, to increase the measure of damages, to fix it in some places, and finally there came the law that in case of accident the employer shall pay absolutely a fixed amount.

That was the first direct response to a condition which had become intolerable.

One cannot live on sentiment, and the employee cannot accept charity and retain his self-respect and his independence as a citizen. Therefore the plan must be built up soundly upon the theory that a man who is well taken care of is better than a man who is neglected.

A good man will do more work in eleven months than in twelve. A man who knows that those who are dear to him have reasonable security will work with a better heart and more fidelity than a man who does not; and that argument can be extended without limit. Secretary Nagel added that he believed in the initiative of the individual citizen, in the avoidance of protection from the state wherever it can be done. A railroad that is able to report that for a whole year, by reason of its own diligence, vigilance and care, it had not a single accident has accomplished more for the community than if it has made the lowest rate that was ever offered as a result of an order from the Interstate Commerce Commission.

These gentlemen had gone very far, although the speaker suspected that there had been progress of one kind or another made in this country that will respond very promptly to the fullness of their claims. Of course they will be asked if they have not undertaken so much that it will be impossible to stop the progress. That, of course, is always the danger in any new, broad scheme. John Stuart Mill said that the greatest results of new legislation are usually those that no one has thought of, and there may be some such experience here.

The Secretary said he was not a radical in the difference of opinion about that at all. As to the constitutionality of the new laws he should be tempted to say that, in his judgment, such laws might be sustained. When the courts decided that the law of contributory negligence can be changed without injustice to the employer, when the courts held that the rule concerning employees can be changed without constitutional injustice to the employer, he, for his part, did not quite see why that same legislature could not, as a matter of constitutional law, say that in case of accident without wilful neglect on the part of the employee the damage of that accident shall be charged to the business in which it happened. That would be his off-hand view, but he regarded that as of minor importance, because ultimately the constitution will not control these questions. If the constitution is strained too long it will yield, either by amendment or by the action of judges who will obey the public will, be that enforced by recall or not. If you strain the constitution too long and demand that it stand for too much, ultimately the popular will in our government will control. So it is a question not of constitutional law so much as it is a question of sound policy—what ought to be done in our country as a matter of law. Some say that we should have no difficulty in adopting principles of this kind as a matter of state legislation, because these things have been done in England and in Germany. In his opinion, that analogy was dangerous. We must not forget that in those countries the subject is approached from the standpoint of centralized power, whereas in our country it is approached from the standpoint of a free republican form of government, and when the state, as a state, undertakes to say arbitrarily that in a matter of contract between two citizens in the event of accident one shall pay without question, in his judgment it extends a protection to one citizen at the cost of another that ultimately will mean more than appears upon the face of that statute. It is a question of policy. When it comes to state mandate, Secretary Nagel would be afraid of it; but for that very reason he hails and congratulates the committee as the representatives of large private enterprises in bringing forward a suggestion and a plan that will solve this great question voluntarily and not by the mandate of state law.

The provisions for payment in case of innocent accident, the provision for sick insurance, death benefit, and service annuity must appeal to every observing citizen.

He did not believe that it is pure altruism but hoped not because if it is to be successful it must be, from a business standpoint, correct.

Edmund Burke said that Lafayette was the strongest man he knew in starting a revolution and the poorest one in stopping it, and these gentlemen may be charged with the same criticisms; but these gentlemen have not started a revolution, but they have taken a long stride toward stopping one.

This country is threatened with a lot of unripe legislation. Why mince matters? Every one knows it. We have got to cure our mania. We think everything can be done by law. That is our danger. Some of the laws that we now have upon our statute books and that we cannot repeal because they have become a necessity are as drastic as they are because industry and commerce had permitted conditions to drift until the aggressive and drastic power of the government's arm became absolutely essential.

People wonder at the extent of railroad control. But why wonder, when you reflect what the conditions were that had to be cured? The fact is that conditions have come to such a pass that no shipper, however big, and no railroad, however

well equipped, could stand up against the system that had been inaugurated. It had got past the stage of correction or reform by any private power. The rules of the game were false and wrong, and it became necessary for the government to interpose for the introduction of rules of the game that every one would have to mind.

Who can measure the consequence of such a plan?

It would be easy to point to other legislation. We have the Sherman act upon the books, and have been some twelve or fifteen years trying to find out what it means. We think we know now. Four weeks ago there was not a concern engaged in interstate commerce in the United States that knew whether it was guilty or innocent. To-day some of them may not quite know, but they have a way of finding out; and they have just as safe a guide for finding out as any one has in finding out about his own private conduct. There is just one safe rule—when in doubt, decide for the right. Conditions were permitted to drift until the strong arm of the law had to interfere, and it is retarded recognition of a normal demand for improvement that has been the greatest breeder of hasty legislation in this country.

And in contemplating the possibilities of such a situation we must bear in mind that we have to deal not with one government, but with a federal government, and with forty-six or forty-eight individual states, every one of them experimenting at the expense of the situation.

Talk about fair competition! How can two concerns in this country compete fairly, if one of them gets its charter from New Jersey and the other one gets its charter from Kansas? Do they start fair? And that situation might easily be elaborated.

Those are the possibilities and those are the invitations for hasty interference on the part of authorities. The plan outlined, the boldness of it, the clearness of it, the strong backing that it has, is of infinite significance, not only to this industry, but as an example of what may be done and what should be accomplished throughout this country wherever similar conditions exist.

Commerce has been called the pioneer of civilization. That phrase was employed in the early days by one in possession of some valuable charter who went forth to conquer new domains. He put in the entering wedge to get a footing in some foreign country in the hope that ultimately his interests might become large enough to justify his government in backing him with a new territory and thus giving him his first footing to spread the civilization of the home country.

Commerce is the finger of civilization. It has a much larger part to play in its domestic relations, and in that sense this report is of peculiar value in pointing the way to show what can be done, and to demonstrate that the plan is economically true. If this is so no organization can be better fitted to furnish the current, a new light, not only throughout this country, but throughout the world.

ADDRESS BY MR. C. A. COFFIN.

At a special session on Thursday afternoon, Mr. C. A. Coffin, president of the General Electric Company, was proposed by unanimous vote of the executive committee for honorary membership in the National Electric Light Association, and elected unanimously to that grade by a rising vote. In acknowledging the compliment, Mr. Coffin said:

"The next greatest honor to me would be regular membership in the society, a society which has had my admiration, my confidence, has been my support and help in all times of trouble, in all seasons of business depression, in all times when there seemed to be a halt in the march of electrical progress, as sometimes happens. In such periods of stress, suddenly one of our engineers, or one of our official staff, would get an inspiration from you, the skies would brighten, and we would go on to further work, and effort, and with your help, to a measurable victory. We have appreciated the vast encouragement we have received from you, the inspiration and the constant upbearing, the comradeship, communionship that we have had with all of you."

Continuing, Mr. Coffin said that he had especially one message from the busy and happy, fruitful years, in which his organization has been in such close touch with the Association—namely, that he had often been impressed by the fact that the workers in its field are happy in and satisfied with their particular calling in life. "More than that, you should be proud of it, and above both of these, you should be devoted to it." He said that he often has occasion to compare in his mind the most interesting, fascinating work in which the members of the Association are engaged, with the work in what may be called for want of a better name, the old industries—the regular, the standard industries, and he often thinks that if the question were asked, "Would you exchange the work to which you have put your hand for any of these?" that the answer would come promptly that he would not. "Problems in the electrical field have," he said, "the fascinating charm of chance, the great and supreme inspiration of possibility, and the great satisfaction of extraordinary accomplishment in respect to adopting means to ends, in contributing wonderfully, not only to the comfort, but to that which appeals more to the imagination of mankind, to the luxuries and conveniences of every day life. Particularly can it be said of your calling, your art, that there is nothing in it of the element of hundrum, nothing the history of which was old yesterday, or which will become old tomorrow, or next year. There is a human touch with the household, with the cuisine, with cheerful illumination, with that which appeals to the imagination, especially of the fair sex." He referred to the electrical advertising sign, as a marvel, particularly to visiting foreigner, and said that to Mr. Insull and Mr. Gilchrist and his associates a great debt of gratitude was due for the extraordinary work they have done in that art, which is not confined to the conspicuous element of it, but extends to the practical element in that the electric sign educates the public eye to a much higher degree of illumination, accustoms the eye to greater brilliancy, so that what previously seemed a well-lighted office or home, now requires more illumination.

Transportation, he said, has become the great field of industry in modern civilization, but were a friend to consult him about leaving the field of the Association's work to enter that of transportation, he would say, no. For he would miss the personal touch, the co-operation with every individual citizen, that recompense for struggle and work and achievement, that incident to service rendered to a satisfied, responsive community, "in which every citizen whose home is lighted feels that his, and her, and their children's comfort is augmented, their convenience increased, their health preserved, and contentment with life in the city, suburbs or farm, greatly deepened and strengthened. Thus from every point of view members of the National Electric Light Association have occasion to be gratified, profoundly so, with its work, to be proud of it and devoted to it."

In conclusion, Mr. Coffin said that he felt an inspiration in standing before such an assemblage, each member of which represents in his own community the greatest expression of American civilization—there is no luxury greater, no convenience handier, nothing that meets more fully the wants in the everyday life of any community than that afforded in all the various applications of electricity already made, and still others yet to come. "I want to congratulate you all, and I never forget to congratulate myself and my associates, that we have in the members of the Association the support which has been a source of strength for so many years, who are carrying in a way our banner, doing our work, are achieving sometimes triumphs the credit for which unjustly comes to us; and I want you never to forget, and I have said it in your presence before, that we fully appreciate the duty that we owe you, for the work you are doing in our behalf, the problems you solve for us, and the suggestions and improvements which you are quicker to make than are we."

General Report of the Convention.

THE convention of the National Electrical Light Association, held in New York City, was phenomenal in many respects. It was certainly the most successful ever conducted by the organization, and in point of attendance surpassed the convention held last year in St. Louis by over 2500, the total registration being 5149.

During the year the association has enjoyed most unprecedented growth, the gross gain in new members during the year being 3919, and the total membership at the present time being in excess of 8800. Five geographic sections affiliated during the year and company sections were formed in five cities. In point of numbers the company sections represent over 62 per cent of the entire organization.

There were over eighty entries listed on the program, necessitating three simultaneous meetings. The sessions were held in the main auditorium, north assembly room and south assembly room of the Engineering Societies Building on West Thirty-ninth Street. This structure is the finest of its kind in the world. The main auditorium has seats for approximately 1200 persons, and the other meeting rooms were ample for the purpose. Never before have sessions of the association been held under such ideal conditions.

The registration of members and distribution of badges and papers followed a carefully arranged plan. The entire east side of the lobby was occupied by a counter subdivided into sections for this purpose. On the north side of the lobby were the headquarters of the membership committee, stenographer, transportation committee and the public telephone stations. Beyond the telephone room were three elevators, providing rapid service to the main auditorium and gallery and to the two meeting rooms on the fifth floor, one having accommodations for 600 and the other for 450. A check room was located on the second floor. The offices of the association are located on the eighth floor of the building, and on the sixth floor there was a catalog display of the exhibition committee. The headquarters sub-committee on theater tickets was also located on the sixth floor, and in an assembly room on this floor were the headquarters of the New England, Pennsylvania and Eastern New York Sections and also of the Sons of Jove. Through the courtesy of the New York Telephone Company local telephonic communication was provided gratis to members wearing the badge of the association.

Entertainment features in abundance were provided for the guests and members, as noted elsewhere in this report. The public policy meeting at the New Theatre on Wednesday evening brought out a most enthusiastic crowd, as befitted the presentation of a report considered to be the most thoroughgoing and far-reaching effort yet made by any large body of employers in this country to reduce friction with employees, and to inspire the devoted service which springs from good feeling. Mr. John F. Gilchrist was elected president of the association at the closing session on Friday afternoon.

FIRST GENERAL SESSION.

The convention was called to order at 10:20 a. m., after which President Freeman introduced Hon. John Purroy Mitchel, president of the New York City Board of Aldermen. Mr. Mitchel said that the City of New York seldom had the opportunity of welcoming the delegates to a convention so truly national in scope. He referred to the electrical industries as factors in municipal comfort, wealth and progress, but said that the progressive economic principles and enlightened social ideals toward which the body is striving lent most interest to the event. The convention, he said, promised to be epoch-making in the electrical industry, owing to the probable adoption of plans calculated to place the business represented in the forefront of civilization and economic progress.

After responding in proper terms to the welcoming address of Mr. Mitchel, President Freeman presented his annual address, an abstract of which is printed elsewhere.

Vice-President John F. Gilchrist, of the Commonwealth Edison Company, Chicago, in the chair, appointed a committee to consider the president's address, consisting of Mr. H. M. Byllesby, of Chicago; Mr. A. A. Dion, of Ottawa, Can., and General George H. Harries, of Washington.

Mr. Arthur Williams, chairman of the entertainment committee, then reported the arrangements made for entertainment during the convention. President Freeman referred in high terms to the work of the entertainment committee, after which Mr. H. H. Scott presented the report of the committee on membership, which showed a total membership of 8665 and a net gain of 3143 since the last convention. Mr. T. C. Martin then presented his report as secretary, which, with the report of Mr. Scott, is abstracted elsewhere.

Mr. W. H. Blood, Jr., then presented his report as insurance expert, which showed that, as the result of action taken by the association last year, reductions in fire insurance had been obtained by many companies.

OVERHEAD-LINE CONSTRUCTION.

The preliminary report of the committee on overhead-line construction was then presented by Mr. Farley Osgood, of the Public Service Electric Company, Newark, chairman. Mr. Osgood referred to the great labor in securing harmony with respect to specifications for overhead crossings, but finally the various conflicting interests were brought to agreement. One thousand copies of the complete report had been sent out for criticism, but the replies brought up very few questions that had not been discussed in meetings of the committee; consequently the report was in condition to be offered for final adoption. An abstract of the report and its discussion is printed elsewhere.

Mr. John L. Bailey, of the Baltimore Consolidated Gas & Electric Company, presented, as chairman, a preliminary report of the committee on uniform accounting. The full report was considered at a later meeting of the accounting section, an account of which appears elsewhere. Mr. T. C. Martin presented his report on progress, an abstract of which is given elsewhere, which was followed by the paper of Mr. Paul Lupke, of the Public Service Electric Company, Trenton, N. J., on "Master and Man," abstracted elsewhere. After the presentation of Mr. Lupke's paper President Freeman stated that the subject which it dealt with would be discussed at a meeting of the public-policy committee at the New Theatre on Wednesday night.

PRESENTATION OF PORTRAIT OF MISS BILLINGS.

Mr. W. C. L. Eglin, of the Philadelphia Electric Company, then presented, on behalf of Mr. H. L. Doherty, a portrait of Miss Harriet Billings, assistant secretary and treasurer of the association. In his remarks Mr. Eglin asked the association to look back for a moment at the time when it was very much younger. About twenty years ago all of its work was practically carried on by two persons, namely, Miss Billings and the president, and the great bulk fell to the former. Miss Billings in addition engaged actively in all of the work of the committees and edited the *Transactions*, which stand as the best record of the work of the association, while their editing is one of the best records that could be left by any person. Miss Billings also had the faculty of inspiring confidence and enthusiasm in the work of the association on the part of its members, and her many sacrifices and her unselfish work should always receive the heartiest appreciation. With her portrait in the headquarters of the association, there will always be something to remind one of his duties to the association and encourage him to give his best when working for it.

In accepting the portrait, President Freeman regretted that Miss Billings was not present, which was due to an apprehension that the strain of meeting so many old friends would be unwise for her to bear. Upon motion of Mr. Paul Doty, seconded by Mr. Samuel Insull, a telegram was sent to Miss Billings on behalf of the association expressing its high appreciation of her work. The general session then adjourned.

THE QUESTION BOX.

At the opening of the second general session on Tuesday afternoon Mr. M. S. Seelman, Jr., of the Brooklyn Edison Company, presented his report as editor of the Question Box. Mr. Seelman strongly recommended that, instead of having the work on the Question Box done by a member company through one of its employees, provision should be made for carrying it on in the office of the association by a thoroughly competent man.

A report then followed of the committee on Question Box revision, Mr. Alexander J. Campbell, New London Gas & Electric Company, chairman. Mr. Campbell stated that the material is now in the hands of the printer, and the book will soon be issued. Owing to the fact that in the revision the editors were limited to the questions and answers in the past issues of the Question Box, the work is not as adequate as it otherwise might have been; they felt, however, that the revision is merely the first step toward the issue by the association of a comprehensive handbook covering all phases of engineering and operation connected with central-station work. The committee joined in the recommendation of the editor of the Question Box, that the association should engage the services of a competent man to issue the *Bulletin*, including the Question Box.

LIBRARY COMMITTEE.

Mr. Arthur Williams then presented the report of the library committee, which included a recommendation that the association shall make an annual appropriation for the purpose of adding to the library of the Engineering Societies in the same building books of value to the association, which otherwise would not be found in the library. He thought it would be better to do this than for the association to build up a complete library of its own.

HANDBOOK COMMITTEE.

The report of the committee on the "Electrical Solicitors' Handbook" was submitted by Mr. Arthur Williams, chairman. It was stated that the new edition has been considerably expanded, particularly in sections relating to illuminating engineering, with many additions to sections on the electric vehicles, and on load and diversity factors.

After presenting his report Mr. Williams stated that the New York Edison Company is planning an educational course, one of the important features of which will be to make solicitors familiar with the handbook, for it is believed that any one who thoroughly understands the handbook becomes from that very fact a competent solicitor. He objected to having the handbook increased in size, in which he was supported by Mr. C. N. Duffy, of Milwaukee. Secretary Martin suggested the issue from time to time of supplements to the handbook in order to keep it up to date without a revision requiring reprinting. This gave rise to some discussion, some members approving and others disapproving of the idea, and the matter was finally submitted to the committee for consideration.

Mr. E. A. Edkins, of Chicago, presented a paper on "Company Sections and Company Section Bulletins." After sketching the history of the bulletin idea, he gave an account of the various central-station bulletins that have been published in the past and are now being issued, and pointed out the great benefit in the publication of bulletins by company sections.

AWARD OF DOHERTY GOLD MEDAL.

Mr. W. C. L. Eglin, of Philadelphia, chairman of the Doherty gold medal committee, then made his report of award of the medal offered by Mr. Henry L. Doherty about a year ago for the best paper presented at a company section meeting. Mr. Eglin stated that twenty-nine papers were received from various company sections, from which three were selected as of highest merit, and upon further examination the committee was unanimous in reporting in favor of a paper by Mr. Charles J. Russell, of the Philadelphia Electric Company, having for its subject "Load and Diversity Factors." President Freeman then presented the medal to Mr. Russell, who in appropriate terms acknowledged the honor conferred upon him. Mr. Russell said that when the paper was prepared there was no though of submitting it for an award, and, in fact, at the time the medal had not yet been offered. The sole object of preparing the paper was to stimulate discussion and the study of subjects of high economic importance to every central-station man. In reply to an inquiry, President Freeman stated that Mr. Doherty desires to make a similar offer of a medal annually.

Following the presentation of the Doherty medal there was a general discussion on company sections and company section bulletins, in which subjects the greatest interest was manifested. An abstract of the discussion will be found elsewhere in this issue.

FIRST TECHNICAL SESSION, TUESDAY AFTERNOON.

At the first technical session, held on Tuesday afternoon, two reports of committees were submitted for discussion and three papers were read. Mr. F. M. Tait, of Dayton, presided.

METER COMMITTEE REPORT.

The meter committee, of which Mr. G. A. Sawin, Newark, N. J., was chairman, submitted a report divided into two distinct parts. In the first part were recorded the practices of various operating companies and the improvements in constructive details introduced by various manufacturing companies. The second part was devoted to the meter code, which was recommended for adoption by the member companies.

The paper was discussed by Messrs. H. H. Lyon, Buffalo; Alfred Herz, Chicago; S. G. Rhodes, New York; L. F. Mowry, Providence; A. G. Strickrott, Schenectady, and G. A. Sawin. Mr. Mowry claimed that for use in meters having an unbalanced retarding torque giving a side thrust on the bearing sapphire rings can advantageously be employed with the cupped diamond bearing. Mr. Rhodes remarked that the friction with this arrangement might be quite as great as with the deeply cupped diamond bearing. Mr. Sawin stated that some companies follow the practice of re-cupping the bearings at each inspection in order to avoid excessive friction.

REPORT ON GROUNDING SECONDARIES.

Mr. W. H. Blood, Jr., Boston, as chairman of the committee on the grounding of secondaries, submitted a report in which attention was called to the present unanimity of opinion as to the advisability of grounding secondary alternating-current circuits, the only difference of opinion now existing being with reference to the limiting voltage beyond which grounding should not be carried. The committee recorded its unanimous opinion that it is unwise to ground circuits operating at an emf in excess of 150 volts.

The discussion was participated in by Messrs. Farley Osgood, Newark; H. L. Wallau, Cleveland; H. A. Holdrege, Omaha; Alfred Herz, Chicago; P. M. Lincoln, Pittsburgh; C. H. Stevens, Brooklyn; L. F. Mowry, Providence; Paul Spencer, Philadelphia, and W. H. Blood, Jr. Mr. Osgood explained that the fire underwriters have not made the grounding of circuits mandatory because the fire risk is not lessened by grounding, and expressed the hope that the committee of the American Institute of Electrical Engineers, which recommends grounding all circuits having voltages below 250, and the committee of the association, placing the limit at 150 volts, could find a common limit satisfactory to all persons.

PROTECTION OBTAINED BY GROUNDING.

In a paper entitled "Grounding of Low-Tension Circuits as a Protective Measure," Mr. Paul M. Lincoln, Pittsburgh, discussed the conditions under which comparatively high-voltage strains may appear between the low-tension windings and core of a transformer.

The discussion on this paper assumed the form of an oral Question Box. In reply to a question by Mr. J. W. Brown, Brooklyn, Mr. P. M. Lincoln said that the current produced by the condenser relations when the secondary circuit is grounded is very small, as may be appreciated from the fact that the effective impedance of the condenser circuit is many megohms. Mr. Brown claimed that since the current is negligible the

effect upon a person who might touch the circuit should not prove fatal and seldom should be disagreeable.

SINGLE-PHASE MOTOR IMPROVEMENTS.

Mr. W. A. Layman, St. Louis, read a paper in which were given outline descriptions of the fundamental principles of operation of two new types of single-phase motors, one being of the constant-speed and the other of the adjustable-speed type.

The characteristics of the motors described were well shown by means of a practical demonstration upon motors of the two types operated under service conditions. The demonstration proved that the constant-speed motor consumes a considerable component of leading wattless current at no load and at a power-factor of 0.96 at full load, and that the adjustable-speed motor can deliver any desired speeds by equipping it with the proper controller. The paper was discussed by Messrs. John C. Parker, Rochester; P. M. Lincoln, Pittsburgh, and the author. Mr. Parker remarked that there are many applications for the adjustable-speed alternating-current motor and expressed the hope that American manufacturers will soon respond to the demand for adjustable-speed polyphase motors, such as are now being made in Europe.

STATION EQUIPMENT FOR MODERN LOAD CONDITIONS.

In a paper entitled "Relation of Modern Load to Station Equipment" Mr. F. D. Newbury, East Pittsburgh, outlined the load conditions which affect the selection of generating equipment for an alternating-current station. He stated that the average operating power-factor of such a station is about 80 per cent. An improvement in power-factor means a lessened kva rating to the generators. Synchronous motors are advantageous in giving control of the power-factor of the system.

In the discussion, which was participated in by Messrs. H. L. Wallau, Cleveland; P. M. Lincoln, Pittsburgh, and F. D. Newbury, the disadvantages of electric spot welding as a station load were pointed out. Mr. Lincoln said that the welding energy should be furnished by a generator driven by an induction motor equipped with a flywheel to minimize the excessive fluctuations in the demands upon the generator as they are transmitted to the supply system.

FIRST ACCOUNTING SESSION.

The accounting sessions of the 1911 convention proved to be one of the most successful features of the business meetings. The attendance was much larger than at any previous sectional meetings, and the success of the papers and the extended discussion which they aroused was gratifying to the officials of the association and the members of the accounting committee. The character of the sessions was indicated by President W. W. Freeman when he stated at the last meeting over which he presided as chairman that the accounting section had the distinction of beginning its meetings first and ending them last.

The first session on May 30 was called to order by Mr. John F. Gilchrist, of Chicago, Ill., at 2:30 p. m. Before the formal business on the program was begun Mr. E. J. Allegaert, Newark, N. J., and Mr. C. N. Jelliffe, New York, were appointed a committee to draft resolutions regarding the recent death of Mr. R. D. Rubright, of Brooklyn. At a subsequent session a resolution expressing the regret of the association was passed.

UNIFORM SYSTEM OF ACCOUNTING.

The report of the committee on a uniform system of accounting was presented by the chairman, Mr. John L. Bailey, of Baltimore, Md. The committee is endeavoring to interest more members in the standard classification, and will make several efforts to secure its adoption by companies and State commissions. Already the Maryland Public Service Commission has formally adopted the system. The committee also recommends the establishment of a statistical bureau and the adoption of standard forms Discussion upon the report was opened by Mr. H. M. Edwards, of New York, who stated that the statistical information would be of the greatest value to both large and small companies. This can be interchanged in such a way that names of individual companies can be given by mutual agreement, if desired. Mr. Frank J. Baker, Chicago, Ill., spoke of the approval of the standard classification by companies in the Illinois Electric Association.

CUSTOMERS' ORDERS.

Mr. R. F. Bonsall, Baltimore, Md., was unable to be present, and his paper on the subject "Handling Customers' Orders" was read by Mr. Douglass Burnett, Baltimore. This emphasized the impression upon customers of the agreements and forms presented for signature when service is desired. In the ensuing discussion particular emphasis was laid upon the advisability of avoiding disappointment to customers because of delay in furnishing service. Mr. Burnett showed that a form of order can take care at one writing of all of the necessary details. Mr. E. M. Podeyn, of Brooklyn, N. Y., said that a customers' bureau has been organized on geographical lines. Mr. W. A. Cox, of Newark, N. J., has a card record of all unfinished work. Mr. R. S. Hale, of Boston, described a special form for customers, similar to a time table, showing the limits within which work may be expected to be completed. Mr. W. H. Rogers, of Paterson, N. J., requires forty-eight hours' notice in the event of removal by some customers, and a deposit in other cases. Others who discussed the report were Messrs. John F. Gilchrist, Chicago; H. E. Neisz, Chicago, and L. A. Coleman, New York.

COLLECTIONS.

Mr. E. J. Bowers, Kansas City, Mo., then presented his paper on the "Collection of Bills." He favors a cash discount for prompt payment. Mr. Daniel Goss, of Boston, believes in net bills with a systematic follow-up policy in charge of collectors. Mr. Geo. E. Burns, of Chicago, has found a discount advantageous in effecting the prompt collection of money. Mr. J. C. VanDuyn, New York, emphasized the fact that the business status of customers may change. Mr. E. J. Allegaert, of Newark, N. J., thought that if a discount was desired 2 per cent or 3 per cent would be ample. Mr. Herman N. Spoehrer, St. Louis, Mo., had found it effective to bond the troublemen. Mr. Frank W. Smith, of New York, said that collectors had been effective in getting into close personal touch with customers and revealing causes of complaints. Others who discussed the report were Messrs. L. A. Coleman, New York; John F. Gilchrist, Chicago; H. M. Edwards, New York; W. H. T. Jones, New York; W. H. Rogers, Paterson, N. J.; Leon H. Scherck, Newburgh, N. Y.; Louis H. Egan, Kansas City, Mo., and W. E. Freeman, New York.

ELECTRIC VEHICLE ACCOUNTS.

Mr. Herman N. Spoehrer of St. Louis, Mo., then read his paper on "Electric Vehicle Accounts as Applied to a Department of a Central-Station Plant." This described the garages of the company, the rates for service and the classification of accounts employed in this department. Mr. J. H. Scobell, of Cleveland, said that business in Cleveland is largely with pleasure vehicles. Mr. W. H. Blood, Jr., was particularly interested in the classification of accounts, and said that the standardization committee of the Electric Vehicle Association is at work upon various matters, including a uniform charging plug for electric vehicles. Mr. Douglass Burnett, of Baltimore, said that the company in that city has established a garage for commercial vehicles. Others who discussed the report were Messrs. E. W. Goedgen, Chicago, and J. W. Brennan, Detroit, Mich.

SECOND ACCOUNTING SESSION.

Mr. F. M. Tait, Dayton, Ohio, called the meeting to order on May 31 and acted as chairman.

TRACING STORE-ROOM MATERIAL.

Mr. John T. Brady, of Denver, read his paper on the subject, "Tracing Store Room Material." He emphasized the importance of the store-room and said that no material should be given out to any official without a requisition. The various points of the paper were discussed in much detail. Mr. E. S. Brock, of Newark, N. J., recommended the bound ledger. Mr. H. M. Edwards, of New York, asked whether store-room wagons should be under the charge of store-keepers. Mr. F. L. Leitner, of Brooklyn, N. Y., said that the substitution of one class of material for another was a great cause of dis-

crepancies. Mr. W. H. Bogart, of New York, described the system of the New York Edison Company. Mr. E. J. Allegaert, of Newark, N. J., had found it advantageous to segregate the appliances and supplies from the regular materials. Mr. J. C. Campbell, of Detroit, Mich., found the card system more flexible and involving less labor than a book system. Mr. W. E. Freeman, of New York, recommended the appointment of a stores inspector to report to the auditor. Mr. C. F. Bryant, Mt. Vernon, N. Y., said that materials could be transferred from one district to another. Mr. J. H. Gulick, of Chicago, Ill., has various calls for material checked at unexpected times. Others who discussed the report were Messrs. William Schmidt, Jr., Baltimore; H. F. Frasse, Brooklyn, and John F. Bailey, Baltimore.

PURCHASING DEPARTMENT.

Mr. T. W. Buxton, of Brooklyn, N. Y., in his paper on the "Purchasing Department" strongly advocated the complete control of purchase and orders by the purchasing department. In the discussion the best means of avoiding double payment of bills were discussed. It was recommended that goods be ordered in the regular way through the purchasing department and that some method of control over the original invoice be held. Mr. J. C. Collins and Mr. E. C. Scobell, of Rochester, N. Y., recommended the uniform bill system. Those who took part in the discussion were Messrs. John L. Bailey, of Baltimore; John T. Brady, of Denver; W. E. Freeman, New York; E. A. Barrows, Providence, R. I.; William Schmidt, Jr., Baltimore; C. F. Bryant, Mt. Vernon, N. Y.; E. J. Allegaert, Newark, N. J.; F. L. Leitner, Brooklyn, N. Y.; J. W. Brennan, Detroit.

JOB COST SYSTEM.

In his paper on "Advantages of a Job Cost System" Mr. A. L. Holme, of New York, described the system of the New York Edison Company. It was agreed in the discussion that the system provides an accurate record of costs, tends to keep the expense within the estimate, and acts as a check on expenditures generally. Those who took part in the discussion were Mr. John L. Bailey, Baltimore; William Schmidt, Jr., Baltimore; J. W. Brennan, Detroit; Paul R. Jones, New York; J. W. Flower, Brooklyn, N. Y.; E. J. Bowers, Kansas City, Mo.; H. M. Edwards, New York; Hermann Spoehrer, St. Louis, Mo.; W. E. Freeman, New York; F. L. Leitner, Brooklyn, N. Y., and J. C. Collins, Rochester, N. Y.

SECOND TECHNICAL SESSION.

Although the second technical session was not scheduled to require more than the morning of Wednesday, the discussion on the first report presented was so interesting and prolonged that an afternoon session was required to complete the program. Fortunately the condition of the weather precluded the possibility of carrying out the entertainment program for the afternoon, so that the second part of the session did not conflict with any other arrangements. Mr. W. C. L. Eglin presided.

OVERHEAD LINE CONSTRUCTION.

The report of this committee, of which Mr. Farley Osgood, Newark, N. J., is chairman, contained 195 pages, and was presented in abstract. The work represents three years of labor. The work of previous years has been revised and to it has been added a section covering specifications for overhead crossings of electric wires over railroad right-of-way, tracks or lines of wires, which specifications further apply to electric wires carrying over 5000-volt constant-potential energy crossing or constructed over telephone, telegraph or other similar lines. With so many conflicting interests the report of necessity represents a compromise and is offered by the commitee as embodying the American standard of overhead line construction. It is divided into four sections, the first of which comprises specifications covering methods of overhead line construction for 2300-volt distribution and for street lighting circuits, together with specifications for material. The second section contains specifications covering methods of overhead line construction for secondary circuits, including pole wiring for street lighting work. The third section is made up of an inter-company agreement form and specifications for the joint use of poles by central-station and telephone companies. The fourth section is in reality a joint report of the committee on overhead line construction of the National Electric Light Association, the high-tension transmission committee of the American Institute of Electrical Engineers, the committee on power distribution of the American Electric Railway Association, the committee on high-tension wire crossings of the Association of Railway Telegraph Superintendents, and the sub-committee on electricity of the American Railway Engineering and Maintenance-of-Way Association. This part of the report covers nine pages with eighteen pages of appendices; one on wind and ice load; the second comprising tables and curves of conductor sags; the third embodying specification for galvanizing for iron and steel; the fourth being made up of pole formulæ, and the final appendix showing drawings of typical crossings. It was hoped by the committee, in view of the agreement reached among the conflicting interests, that no changes would be made, but that the report will be accepted as printed. This suggestion of the chairman of the committee was also indorsed by Messrs. B. F. Pearson, Los Angeles, Cal.; W. K. Vanderpoel, Newark, N. J.; W. C. L. Eglin, Philadelphia, Pa.; W. W. Freeman, Brooklyn, N. Y.; Paul Spencer, Philadelphia, Pa., and P. H. Thomas, New York. There were others, however, who spoke in opposition to the indorsement without modification. Messrs. E. H. Davis and G. E. Wendle, of Williamsport, Pa., doubted whether the specifications were sufficiently in accord with standard practice and whether some of the provisions were not too drastic. While they appreciated the work of the committee, they could not subscribe to the fourth section of its report, since this condemns all existing types of crossings that are not in accordance with the standard therein contained. Mr. Davis cited court-findings which were at variance with the recommendation for clearances given in the report.

Mr. A. S. Miller, St. Louis, Mo., felt that in view of the fact that the report stands as a precedent and yet was only available to the members when they registered at the convention it was too important to adopt without more study being allotted to it. Prof. A. S. Richey, Worcester, Mass., speaking as the representative of the American Electric Railway Engineering Association, asked the N. E. L. A. not to adopt the specifications for the joint use of poles until the American Electric Railway Association had an opportunity to meet the National Electric Light Association in joint committee for a full discussion of the matter. There were a number of matters in the section which were not in accord with standard electric railway practice and were not just, he said, to electric railway interests. This part of the report was practically the verbatim specifications of the American Telegraph & Telephone Company, he maintained, and the railway association objects to some of the methods of telephone construction covered in the report. Mr. W. C. L. Eglin said that it was impossible to obtain agreement on matters of this kind and that it was necessary for the association to adopt a standard on important questions and that definite action at the present time was vitally necessary. Mr. A. S. Ives, of Poughkeepsie, N. Y., drew attention to various parts of the report which were at variance with the practice of his company and felt that some modifications were advisable. Others joining in the discussion were Messrs. G. H. Lukes, Chicago, Ill.; William Brophy, Boston, Mass.; G. H. Whitfield, Richmond, Va.; I. E. Moultrop, Boston, Mass., and L. A. Ferguson, Chicago, Ill. In conformity with a suggestion made by President Freeman and indorsed by Past-president Ferguson the sense of the meeting was expressed in the form of a motion that the members of the technical section recommend to the executive committee of the association that the report be adopted. This motion was carried.

PRESERVATIVE TREATMENT OF POLES.

The report of the committee on preservative treatment of poles and cross-arms, of which Mr. W. K. Vanderpoel, Newark, N. J., is chairman, was divided into two parts, dealing respectively with preservatives and treatments. The report on preservatives was confined to creosote oil and methods for its introduction into line timber, the committee's attitude being

that evidence that other processes can be as successfully applied as creosote are lacking. The high pressure, atmospheric pressure and brush treatments were discussed in detail, and for the purpose of assisting the buyer in obtaining the best service from companies engaged in this work specifications for high pressure treatment were given in detail. General directions were incorporated in the report for applying the atmospheric pressure treatment, and suggestions were offered as to the application of the brush treatment, which is the least effective, but cheapest, of the three processes. The report was discussed by Messrs. R. D. Coombs, Newark, N. J.; F. B. H. Paine, Buffalo, N. Y.; Paul Spencer, Philadelphia, Pa.; H. A. Holdrege, Omaha, Neb.; W. L. Abbott, Chicago, Ill.; B. F. Pearson, Los Angeles, Cal.; A. Eisenhauer, New York, and Dr. G. Alleman, New York. Mr. Paine compared wooden poles and towers for 60,000-volt transmission lines with reference to the question of narrow rights-of-way, the wooden line being more flexible and convenient than any possible tower line. The only possible objection to the wooden pole line, he said, would be based on its life, but with preservative methods he felt this objection might be brushed aside. Mr. Holdrege said that southern pine poles treated by the high-pressure process showed no deterioration after five years of service. The conductivity of the pole, however, due to its preservative impregnation, renders it necessary to dispense with the creosoted pole where transformers are hung and at crossovers and corners. Mr. Pearson related his experiences with the open hot tank treatment followed by cold immersion and also with the creosote and carbolineum processes. Dr. Alleman, who is a member of the committee, answered numerous questions which arose in the course of the discussion relative to the preservatives and their effects on the wood. He cautioned members against the frauds possible in the creosoting business and suggested rigid inspection of all creosoting work done by contract.

UNDERGROUND CONSTRUCTION.

The report of the committee on underground construction presented by Mr. W. L. Abbott, of Chicago, its chairman, recorded the results of investigations relating to conduit construction, cables, the installation of cables, auxiliary subway equipment and operation. The chief features of the report were specifications for cable joints, comparisons of various conduit materials, hints as to the prevention of electrolysis and the protection and separation of cables in manholes, outline of methods for quickly locating and repairing cable breaks and a description of selected devices for indicating the lowering of cable insulation. The report was discussed by Messrs. Farley Osgood, Newark, N. J.; W. K. Vanderpoel, Newark, N. J.; S. B. Way, St. Louis, Mo.; Philip Torchio, New York; G. E. Brown, Brooklyn, N. Y.; W. N. Ryerson, Duluth, Minn.; F. B. H. Paine, Buffalo, N. Y., and W. C. L. Eglin, Philadelphia, Pa. In answer to a question by Mr. Osgood, relative to the use of concrete conduits, Mr. Way said that the system first used in St. Louis, Mo., has been tried in Joliet, under unfavorable circumstances, only to be abandoned. Mr. Paine called attention to the use of lead-covered cable laid directly in the ground without conduit in Germany, and said that this construction was well suited for use in streets not paved. Mr. Torchio said armored cables were used in Central Park, New York, in connection with tungsten-lamp installations. Replying to a question by Mr. Vanderpoel, Mr. Eglin said an effective method of ridding a manhole of gas is to employ a false air-tight manhole cover, and drive out the gas by means of compressed air.

LOAD REPORTS.

In a paper by Mr. A. S. Loizeaux, Baltimore, Md., were shown sample load reports of an electric system, including daily output summary, special day load curves, daily load curves of large customers, monthly reports of energy generated, energy purchased, energy delivered to commercial lines, monthly load statements, graphic load record, maximum peak and maximum output, yearly tabulation of energy statistics, peak loads, load factors, etc. The report was discussed by Messrs. W. C. L. Eglin, Philadelphia, Pa.; Farley Osgood, Newark, N. J.; N. J. Neall, Boston, Mass., and Douglass Burnett, Baltimore, Md., who presented the paper in the absence of the author. Mr. Neall accentuated the importance of keeping records such as those described by the author, especially since the formation of commissions in the various states. Mr. Eglin, as the presiding officer, expressed the sense of the meeting as favorable to the standardization of the form of load reports and characteristic load curves of central stations.

FIRST COMMERCIAL SESSION.

The first Commercial Session convened on Wednesday with Mr. J. F. Gilchrist, of Chicago, in the chair.

Mr. George Williams, of New York, chairman of the Commercial Session, in his address at the opening of the session drew attention to the fact that the section has already a membership as large as that of the entire association six years ago. He felt that there is no association work having a commercial side to it which cannot be best developed through the Commercial Section. The latter affords opportunities for commercial men to acquaint manufacturers with consumers' wants and for manufacturers to educate the commercial men. He suggested the affiliation of the committee on the "Solicitors' Handbook" with the Commercial Section and felt that with the sources of information available that section could supply a genuine all-the-year-round service such as has never been given in any commercial association. Mr. C. N. Duffy, of Milwaukee, Wis., asked whether it would be feasible to carry out the latter suggestion of the chairman of the section and was told that the matter would be taken up in executive session.

REPORT OF POWER COMMITTEE.

The report of this committee, presented by its chairman, Mr. E. W. Lloyd, of Chicago, embodied much data relative to the motor development of the various industries, the maximum demand and energy consumption, in addition to tabulated data on horse-power required to drive various machines, including refrigerating machines. The committee felt that the hard work done in the last few years by commercial departments has had its effect and that the growth of motor loads should increase at a much more rapid rate in the future. For soliciting this class of business the committee recommended engaging young men from technical schools whose training rendered them competent to make analyses of all the conditions entering into the cost of making electricity in private plants. In its compilation of data relative to the horse-power required to drive different types of machinery the committee has not duplicated data already covered in the "Solicitors' Handbook." Valuable information on the average consumption of energy per ton of ice delivered on the loading platform was incorporated in the report. It is pointed out that this should not exceed 60 kw-hours per ton and that the result might be accomplished at not less than 50 kw-hours. Mr. C. E. Graves, of Brooklyn, expressed the hope that in future years the responses to letters from this committee would be more liberal. Confidence in the information is bred with the volume of replies received, numerous instances carrying more weight than one or two. Mr. M. O. Dell Plain, of Syracuse, N. Y., suggested that in its future work the committee make use of graphic wattmeter tests of motor installations, noting all of the conditions on the back of the record. Mr. H. J. Gille, of Minneapolis, Minn., suggested that the committee also endeavor to ascertain the approximate kw-hours per unit of manufactured product. Mr. R. L. Lloyd, of Philadelphia, Pa., spoke on automatic refrigerating machines.

ELECTRICITY IN RURAL DISTRICTS.

In its report to the convention the committee headed by Mr. John G. Learned, of Chicago, showed that the possible income from rural industries other than farming was such as to make the matter worth careful study and investigation. The report is divided into several sections, each treated by itself and also with reference to the whole; the object being to reflect the situation as it exists from the viewpoint of the central station and the interurban electric railway. The committee points out that unless reasonable rates for this service are offered recourse will be had to other means such as gasoline engines for

motive power and acetylene and pressure-oil systems for illumination, all of which were being constantly offered to the inhabitants of rural districts. It suggested also that the business be encouraged by such inducements as instalment payment for utensils or motors, cost prices on wiring, etc. The committee touched in a general way on numerous rural industries such as stone quarries, brick yards, lumber yards, grist mills, cement mills, etc., which it would be most practical and profitable to reach. The report concludes with a list of articles germane to the subject of electricity in rural districts which appeared in the technical press and other publications. Mr. S. M. Kennedy, Los Angeles, Cal., discussing the report, gave information on the lines operated by his company in southern California. The highest standard of line construction, he maintained, is necessary and the average cost of extending lines, he stated, depends on the voltage and the territory served, ranging from $600 to $1200 a mile. Where low rates prevail in typical rural districts the consumer should pay for the transformer, but where the rates are fairly high the company should furnish this equipment. Mr. J. C. Parker, Rochester, N. Y., dwelt on the possibilities offered in reclamation and irrigation work, stating that the reactive effect on the country itself would usually justify running the extensions. Mr. E. P. Edwards, Schenectady, N. Y., suggested that members digest the information given in a bulletin issued by the United States Department of Agriculture entitled "The Cost of Producing Minnesota Farm Products." This gives in detail the cost of animal and manual labor on the farm and would indicate how far a company would have to go in order to compete successfully with this labor by the substitution of the electric motor. Messrs. H. J. Gille, Minneapolis, Minn.; E. L. Callahan, Chicago, Ill.; H. K. Mohr, Philadelphia, Pa.; L. H. Scherck, Newburgh, N. Y., and J. F. Gilchrist, Chicago, Ill., also joined in the discussion on this paper.

ORNAMENTAL STREET LIGHTING.

The arc, festoon or arch, and the post systems of ornamental street lighting are described in detail in the report submitted by the committee on this subject, of which Mr. W. R. Collier, of Atlanta, Ga., is chairman. A list of cities possessing each of the respective systems of lighting is given and the advantages and disadvantages of the various systems are pointed out. The festoon or arch system the committee feels has served its purpose and the trend should be toward a more permanent and more simple system. On its commercial side the committee strongly urges companies to make contracts with cities or with merchants' associations rather than with individuals, the unit of payment being based on the front foot, and this also should be made the unit of installation cost. A number of specimen contracts were appended for the benefit of companies desiring to engage in this work. Mr. V. R. Lansingh, New York, disagreed with the committee in its statement that whether the lamps are placed upright or hang pendent is not of great importance. From tests in his possession he said lamps hanging pendent, all other conditions remaining the same, showed a gain of 35 per cent in light distribution over lamps placed vertically. Mr. T. I. Jones, Brooklyn, N. Y., said that the beauty of the post and its advertising value were of more significance than the type of glassware used. The merchant who bore the cost of the installation wanted his place advertised and the best effect artistically is produced with dense glassware showing a ball of light rather than with globes giving a point of light. Mr. C. N. Duffy, Milwaukee, Wis., was also of the opinion that the scientific side of the question was not of much interest to commercial men and oftentimes marred results. Mr. W. H. Gardner, Lincoln, Neb., felt that inasmuch as more revenue could be produced from signs, outline and window lighting than with ornamental street lighting the latter should not be encouraged at the expense of the former. Mr. S. M. Kennedy, Los Angeles, Cal., showed how the income of his company was more or less curtailed owing to the ornamental lamp-posts in Los Angeles and the inability of his company, because of these, to install sign and outline lighting. He nevertheless felt it a gain to the community and expressed pride at the artistic lighting effects on the streets of his city. Mr. A. S. Ives, of Poughkeepsie, N. Y., urged companies to enlist the municipality in work of this kind because whatever helped the municipalities helped the taxpayer and also redounded to the credit of the central station. Mr. L. H. Scherck, of Newburgh, N. Y., stated that as a result of cooperation wooden trolley poles were displaced by ornamental iron poles in Poughkeepsie holding four lamps; and Mr. Ives vouchsafed the information that the life of tungsten lamps was not impaired by being affixed to trolley poles. Others joining in the discussion were Messrs. H. K. Mohr, of Philadelphia, Pa.; L. Fitzgerald, Gary, Ind., and E. Creed, New York.

EXECUTIVE SESSION.

At the conclusion of the first commercial session on Wednesday noon the association went into executive session. Mr. Arthur Williams, vice-chairman of the public policy committee, touched briefly upon the report of the committee scheduled for presentation that evening at the New Theatre. Mr. Samuel Insull, of Chicago, expressed high appreciation of Mr. Williams' work, and the report of the committee was unanimously accepted.

CONSTRUCTIONAL AMENDMENTS.

Mr. F. W. Frueauff read the report of the committee on form of section organization, in which various recommendations for amendments to the constitution and suggested forms for a constitution for a state or geographic section and for a company section were embodied. A committee consisting of Messrs. F. W. Frueauff, J. F. Gilchrist, F. M. Tait, J. D. Israel, George Williams and D. B. Rushmore was named and instructed to report its findings at the executive session Friday afternoon.

TREASURERS' REPORT.

Gen. George H. Harries, Washington, D. C., treasurer, submitted a detailed statement of receipts and expenditures for the year, showing that the association at that time had total assets of $21,548 with no liabilities except current bills. The total receipts during the year were $62,177, plus cash on hand at the beginning of the year of $7,564, giving a total of $69,741. Disbursements of $51,241 left a cash balance of $18,500. The report was accepted by unanimous vote.

NOMINATING COMMITTEE.

In accordance with the provisions of the constitution the following nominating committee was elected to report its recommendations at the executive session Friday afternoon: Messrs. John W. Lieb, Jr., New York; Charles R. Huntley, Buffalo; R. F. Pack, Toronto; E. H. Davis, Williamsport; M. S. Hart, New Orleans.

FIRST POWER TRANSMISSION SECTION.

The meeting of the first session of the Power Transmission Section was opened by the presentation by Dr. A. S. McAllister of a report of the public conference on water-powers and their governmental control, held under the auspices of the N. E. L. A. Power Section in New York on April 8. The report gives a verbatim account of the proceedings, including the able and opportune address by Secretary of Interior W. L. Fisher.

CENTRAL SUPPLY OF ELECTRICAL ENERGY.

Mr. Fred Darlington, East Pittsburgh, submitted a paper entitled "Central Power Plants and Electrical Supply for Trunk-Line Railroads," in which he presented arguments in favor of a common source of supply of energy for electric lighting, industrial power and railway motors, and railroad electrical terminal service. He believed that railways in particular should not combine electrical generation with traffic operation.

Mr. F. B. H. Paine, of the Niagara, Lockport & Ontario Power Company, Buffalo, agreed with the author of the paper as to the desirability of a central source for the supply of energy for all electrical industries within a given district, and also favored generation for the many small central stations

within a given district at a large central plant. An interesting account was given of the far-reaching service of the company with which he is connected. Mr. R. F. Schuchardt, of the Commonwealth Edison Company, Chicago, considered that the paper of Mr. Darlington was one of prime importance at the present stage of central-station progress, and thoroughly agreed as to the feasibility and efficiency of the supply of electric energy to street railways and to the terminal lines of railroads by existing central-station organizations.

PROTECTION FROM LIGHTNING.

Mr. B. E. Morrow, Albany, presented, as chairman, the report of the committee on protection from lightning. Among its recommendations were that the overhead ground wire should be used, choke coils placed on every independent circuit leaving the generating station and improved types of insulation used for transformers subject to damage from lightning. The use was also recommended of the electrolytic type of arrester on all transmission lines not now equipped with the multi-gap or horn-type of arrester.

An interesting discussion of the report was opened by Dr. C. P. Steinmetz, who said that almost absolute protection from lightning can now be obtained if necessary, although in some cases it may be more economical to take some risk of trouble from lightning than to expend the money necessary to provide perfect protection. In some cases it may be found best to confine protection to apparatus connected with the system.

Prof. E. E. F. Creighton, Schenectady, suggested the use of an ammeter in series with aluminum cells. Messrs. R. P. Jackson, of Pittsburgh, and P. H. Thomas, of New York, thought that it was more desirable to increase the insulation of line and apparatus rather than to set arresters to discharge at a moderate rise of voltage. Mr. P. M. Lincoln pointed out that, in addition to the use of arresters, protection against lightning might be obtained by suspension insulators, overhead ground wire and grounded neutral points.

SECOND COMMERCIAL SECTION, THURSDAY.

Practically the entire time of the Second Commercial Session on Thursday morning under Chairman F. M. Tait was devoted to a discussion of electric vehicle developments.

ELECTRIC VEHICLES.

The report of the committee on electric vehicles was presented by Mr. H. W. Peck, of Rochester, N. Y., in the absence of Mr. J. C. Hutchins, chairman. The report pointed out several important fields of usefulness in central-station work which justified its adoption by operating companies. Not the least important advantage of the electric vehicle is its advertising power in the communities served. There is room for a large amount of additional publicity work to be accomplished in acquainting the public with the possibilities of this type of transportation equipment. The committee emphasized the importance of taking all items of expense into account in estimating the cost of operation of electric vehicle service, and it called attention to the necessity of proper tire selection in order to secure the guaranteed mileage per battery charge. The justice of the lower insurance rates for electric vehicles was also mentioned and the committee pointed out that early difficulties in the operation of batteries, and particularly in their maintenance, are now things of the past.

A long discussion followed the reading of the committee's report. Central-station men from all parts of the country participated, showing the keenest interest in the problems reviewed. Mr. P. D. Wagoner, Long Island City, urged the vital importance of assembling adequate data. He felt that nothing was more important than this in the exploitation of electric-vehicle service. Mr. J. Baker, Boston, called attention to a disposition on the part of insurance companies to lower their rates on electric vehicles when provided with adequate information showing that the fire and accident hazards are as low as are claimed by their advocates. Mr. W. H. Blood, Jr., Boston, called attention to the off-peak value of the electric-vehicle load, and urged the elimination of the gasoline car in central-station service wherever the electric vehicle can do the work to greater advantage. Mr. Wagoner stated that in February, 1911, the sales of his company were greater than in the entire year 1908 or 1909.

Mr. F. W. Frueauff, Denver, said that a central-station solicitor should feel as responsible for the purchase of a gasoline vehicle in his territory as he would for the establishment of a gas-engine plant within the radius of his company's circuits. Mr. H. S. Knowlton, Boston, outlined the work of the Boston Edison Company in connection with its electric-vehicle campaign, and Mr. C. F. Smith, Boston, referred briefly to the appearance of sixty-two electric trucks in a competitive procession at the time of the annual Work-Horse Parade.

Mr. G. H. Whitfield, Richmond, Va., pointed out that the offer of the local central-station companies to garage private vehicles resulted in a great stimulus in sales in that locality, although it has never been necessary to establish the garage. Mr. M. S. Seelman, Jr., Brooklyn, emphasized the value of the publicity game in a road run fostered by one of the New York newspapers. A long discussion took place regarding the question of rates for charging, which appeared to run from about 3 to 8 cents per kw-hour. The participants were R. W. Rollins, Hartford; S. M. Kennedy, Los Angeles; E. L. Callahan, Chicago; H. L. Parker, Baltimore, and T. I. Jones, Brooklyn. At Oklahoma City the revenue from electric-vehicle charging increased in one year from practically nothing to $600 per month, the present income being about $1,000 per month. Mr. E. W. Lloyd, Chicago, advocated placing electric vehicles in local delivery service in connection with the outlying distribution centers of department stores. Mr. Arthur Williams, New York, said that the question of rates for electric-vehicle charging energy is subordinate to other advantages of this equipment. Mr. D. R. Stetson, of New Bedford, Mass., gave an interesting sketch of development of the electric-vehicle service by the New Bedford Gas & Edison Light Company.

EXECUTIVE COMMERCIAL SESSION.

Before the opening of the Executive Session Chairman Tait called attention to the co-operative advertising exhibit which had been placed on the front of the rostrum, consisting of a sample page from the Cleveland *Plain Dealer*, illustrating new electrical devices and containing both advertisements and descriptive articles designed to show the public the trend of electrical progress. Mr. P. S. Dodd, Cleveland, outlined the development of this plan of publicity which has by some authorities been considered about five times as valuable as ordinary newspaper paid advertising. The plan originated with Mr. Turner of the Cleveland Electric Illuminating Company and has been in successful use for two years.

THIRD ACCOUNTING SESSION.

The third and concluding session was called to order by President Freeman, who presided as chairman, on the morning of June 1. Mr. Freeman expressed his interest in the work of the session and stated that the large attendance showed the appreciation of the work of the committee and of the subjects of the papers.

GENERAL OFFICE ACCOUNTING.

Mr. Franklyn Heydecke, of Newark, N. J., then read his paper on "General Office Accounting." He said that in the compilation of monthly statements of operation and profit and loss it is best to furnish the general facts first and follow with the details. Mr. Hermann Spoehrer, of St. Louis, Mo., said that the paper was of special interest to companies which operate several central-station systems. Mr. Frank Birch, of Philadelphia, Pa., stated that the most satisfactory system is one which furnishes not only general data but also details. Mr. W. E. Freeman, of New York, said that the subject of scientific accounting is receiving general attention, with the result of improved efficiency in administration and operation. Dr. Fenner H. Peckham, Providence, R. I., and Mr. E. J. Allegaert, Newark, N. J., also discussed the paper.

ACCOUNTING FOR DEPRECIATION.

Mr. H. M. Edwards, of New York, presented his paper on

the subject "Accounting for Depreciation," which described the practice of the New York Edison Company. Mr. Edwards favors a general charge for depreciation rather than a charge based upon a specific calculation of lives of apparatus that cannot be determined satisfactorily.

Mr. N. J. Neall, of Boston, said that examination of the returns made to the New York Public Service Commission, Second District, showed that a very small proportion of the companies make any allowance for depreciation. Mr. E. J. Allegaert, of Newark, N. J., said that as the purpose of accounting is to determine how much has been made or lost depreciation accounts are a necessary element. Mr. C. N. Duffy, of Milwaukee, Wis., agreed with the advisability of the adoption of the general rather than the specific method. Mr. P. S. Young, of Newark, N. J., said that a company cannot spend enough in maintenance to take care of the waste. Mr. W. H. Gardiner, of New York, suggested the adoption of the general method with some flexibility to permit addition or reduction as conditions warrant. Mr. E. A. Barrows, of Providence, R. I., described the interesting practice of the Narragansett Electric Light Company. Mr. William B. Jackson, Chicago, Ill., felt that the best parts of both the general and specific methods should be adopted and an intelligent approximation made which can be altered as experience shows necessary. Mr. J. H. Gulick, of Chicago, said that the system of the Commonwealth Edison Company is similar to that of the New York Edison Company. Dr. Fenner H. Peckham, of Providence, R. I., said that a unanimous agreement as to the proper rate to be charged should be reached. Mr. J. H. Donlan, of Brooklyn, N. Y., referred to the consideration of depreciation by courts in decisions affecting utility companies.

TABULATING MACHINES IN ACCOUNTING WORK.

Mr. William Schmidt, Jr., of Baltimore, read his paper on the subject, "The Extent to Which a Tabulating Machine Can Be Used in Accounting Work." Mr. Paul R. Jones, of New York, described the uses to which this machine has been put in Denver. Mr. H. C. Schlegel, of New York, stated that mechanical devices made it possible to meet the greatly enlarged demand for statistics and other information. Mr. John L. Bailey, of Baltimore, and Mr. W. H. T. Jones, of New York, also discussed the paper.

As this closed the formal program, Mr. Freeman before adjournment complimented the session upon the conduct of the meetings and the great interest which was shown. Mr. Bailey expressed the thorough appreciation of the committee for the attendance and general interest manifested in the program.

SPECIAL EXECUTIVE SESSION IN HONOR OF THOMAS A. EDISON AND MR. CHARLES A. COFFIN.

President Freeman at 2:30 p. m. called to order a special executive session for the reception of Mr. Thomas A. Edison and for the election of Mr. C. A. Coffin to honorary membership. Mr. Thomas A. Edison was escorted to the Auditorium and took a seat upon the platform amid loud applause, upon the cessation of which President Freeman said it is safe to say that if the attendants at the convention were asked who, above all others, they would most like to see on this platform the unanimous answer would be Thomas A. Edison. Mr. Edison, he said, does not intend to speak, because his deeds speak for him, but he would therefore call on his former associate and very intimate friend, Mr. Samuel Insull, for some remarks.

Mr. Insull said, that of all the honors that it has been his good fortune to receive at the hands of the industry in which all present are engaged there is none so great to his mind as that of rising to give thanks for the cordial reception accorded to his chief, Mr. Thomas A. Edison. Mr. Edison never attempts to address an assemblage, but he desired the speaker to express his heartfelt thanks for the handsome way in which he was received, and wish all the greatest success that can possibly be achieved in the business in which they are engaged. If there is one thing more than another which pleases him it is to be informed that the same old enthusiasm which existed in the electrical field thirty years ago exists among the generation that is now rising identified with the business.

President Freeman then announced that the representatives of the Class A companies would be asked to vote at this session upon a unanimous recommendation of the executive committee as to the election of an honorary member. The association, he said, has on its list of honorary members at the present time twenty-five men of distinction and prominence; and in this, its twenty-sixth year, if the recommendation of the executive committee is accepted, a twenty-sixth honorary member will be added in the person of Mr. Charles A. Coffin. Upon motion of Mr. W. H. Blood, Jr., Mr. Coffin was unanimously elected by a rising vote. In announcing the result, President Freeman said the gentleman just elected to honorary membership represents probably as no other one does the combination of interest in the manufacturing and central-station branches of our industry. While perhaps he is best known as the executive head and guiding genius of a large manufacturing company his personal interests in central-station work are probably as much as they are in manufacturing work.

THIRD COMMERCIAL SESSION.

RESIDENCE BUSINESS.

Following the ovation to Mr. Edison and the election of Mr. C. A. Coffin, of the General Electric Company, as an honorary member, the third commercial section began with the presentation of a committee report on residence business, of which Mr. Clare M. Stannard, of Denver, Col., is chairman. The committee devoted itself only to a general consideration of the subject, making what might be termed a progress report. It concedes the desirability of this class of load provided the distribution costs are reasonable. For this class of service sidewalk and backyard systems of distribution appear to be preferred. Three general methods for getting residence business are outlined and two designs of houses electrically equipped after modern practice form part of the report. The average revenue received per customer is $25 per annum and the average revenue per kilowatt connected is $21 per annum. Mr. H. J. Gille, of Minneapolis, Minn., called attention to the central station's obligation to the community and Mr. P. H. Kemble, of Toronto, Ont., showed the defects of the methods pursued in compiling data by correspondence rather than by personal interviews. Mr. R. M. Searle, of Rochester, N. Y., contributed interesting information on some new and important uses of electric fans in the household and Mr. E. F. McCabe, of Lewistown, Pa., told of increased business secured by his company despite natural-gas competition by means of a flat-rate type of meter. Messrs. D. Burnett, Baltimore, Md., A. S. Ives, Poughkeepsie, N. Y., L. H. Scherck, Newburgh, N. Y. and M. S. Seelman, of Brooklyn, N. Y., contributed to the discussion.

ELECTRIC HEATING AND REFRIGERATION.

The report of this committee was read by Mr. F. H. Gale, of Schenectady, N. Y., its chairman. Four sub-committees each devoted itself to a particular phase of the subject. Apparently consumers have embraced the opportunity of utilizing many of the numerous household electrical devices due to the lesser cost of lighting since the advent of the tungsten lamp. The committee finds much to encourage and stimulate development in this direction. The advantages possessed by a particular electrical device over other standard devices on the market are pointed out. Investigation has not been confined entirely to domestic apparatus; but covers the whole range of devices for industrial service, concerning which much information of value was given. Although the report indicates that electrical refrigeration is confined to a few large cities, hope is held out for interest and development in small refrigerating systems operative from central-station service. A motion picture thrown on the screen after the reading of the report described more eloquently than words could the advantages of electricity in the household. The report itself, however, was not discussed.

WIRING AND EQUIPMENT.

This was the subject of the committee report presented by Mr. M. C. Rypinski of New York. The committee sought to obtain information looking toward the improvement, standardization and, if possible, cheapening of wiring practice, and

with this in view sent out numerous forms, only about 20 per cent of which were returned, however. Apparently very few central-station companies are endeavoring to further the campaign for wiring old and new houses by rendering financial aid to the consumer in the shape of permitting monthly instalment payments for wiring work. There also is a lack of definite knowledge as to what extent the present cost of installations retards wiring of houses. Such suggestions as were received looking to the development of cheaper forms of wiring referred to foreign practice at present not permitted in this country. The National Electric Light Association, National Electric Lamp Association and the National Electric Contractors' Association will issue jointly a wiring handbook suitable alike for the solicitor and the electrical contractor. The report elicited no discussion.

INDUSTRIAL LIGHTING.

This committee, of which Mr. M. S. Sloan, of Birmingham, Ala., is chairman, attempted no analysis of particular systems now in vogue and confined its report to descriptions of what it considered to be model installations. It suggested that its work be continued so that the various methods of lighting might be classified or at any rate data compiled which when placed in condensed form would be helpful to central station men and even to the customer. Mr. N. Macbeth, of Bloomfield, N. J., spoke at some length on the cash value of good illumination in industrial work, lamenting the fact that the importance of industrial lighting as a revenue producer is often overlooked by central-station managers. Mr. M. O. Dell Plain, Syracuse, N. Y., told of the perceptible flicker on 25-cycle energy where radially corrugated reflectors were used with tungsten lamps. This flicker is not noticeable with reflectors having a smooth surface. Mr. C. E. Clewell, of Pittsburgh, Pa., offered an explanation of the phenomenon attributing the defect to light surfaces rather than to particular types of reflectors. Messrs. S. Ashe, Harrison, N. J., F. J. Leitner, Brooklyn, N. Y., S. E. Doane, Cleveland, Ohio, W. D. A. Ryan, Schenectady, N. Y., F. N. Willcox, Harrison, N. J., and H. L. Parker, Baltimore, Md., joined in the discussion, which centered chiefly on the examples given in the report.

THIRD TECHNICAL SESSION.

INCANDESCENT-LAMP REPORT.

Mr. W. F. Wells, of Brooklyn, presented, as chairman, the report of the Incandescent Lamp Committee, which described developments during the year in the methods of manufacturing tungsten lamps, standardization of lamp sizes and ratings, and referred to the increase in the use of 400 and 500-watt units. In reply to inquiries, Mr. Wells stated that it would not at present be practicable to renew tungsten lamps absolutely free, and that customers cannot be required to purchase tungsten lamps exclusively from central stations.

PRIME MOVERS.

Mr. I. E. Moultrop, of Boston, submitted, as chairman, the report of the Prime Motive Powers Committee, which includes much valuable practical data of a wide range collected during the year. Mr. E. E. Gilbert, Schenectady, N. Y., said that it was a decided step in the right direction to insist upon clean air for ventilating generators. Mr. John C. Parker, Rochester, said that the increasing use of accumulators in connection with the governors of hydraulic turbines is a good thing. He said that a strong point could have been made of the advantage of the bleeder type of turbine if used in connection with exhaust steam heating. He referred to a new European type of gas engine of very high efficiency, and which should be a valuable adjunct to a hydraulic plant, displacing the steam engine auxiliary. Mr. R. D. De Wolf, of Rochester, referred to the importance of exhaust steam heating in connection with electric-power generation, and particularly to the use for this purpose of the bleeder-type of steam turbine, which promises to come largely into use. Mr. Moultrop stated that 10,000-hp gas engines are now being built in Germany and France.

ELECTRICAL APPARATUS.

Mr. G. L. Knight, of the Brooklyn Edison Company, read the report of the Committee on Electrical Apparatus, in the absence of the chairman, Mr. L. L. Elden, of Boston. The report gives the results of tests of 12,000-kw turbogenerators. The insertion is advised of reaction in generator-leads as affording protection to the generator when the circuit breaker is open. Mention was also made of the use of auto transformers for the same purpose.

In the discussion, Mr. W. F. Wells, chairman, suggested the placing of fuses over the top of air-cooled transformers, so that as soon as a flame commences to come out the blower would be automatically shut down. Mr. F. D. Newbury, Pittsburgh, said that generators can be built with sufficient internal reactance to avoid the use of external reactance. Referring to high and low-speed machinery, he said that the former can be made equally quiet in operation, provided the apparatus is properly enclosed. Mr. R. F. Schuchardt, Chicago, said that a series of tests had resulted in a very much increased confidence in oil switches.

Mr. E. M. Hewlett, Schenectady, referred to the changes in the bellows type relay to make it more selective. Mr. Moultrop stated that while the present form of relay is selective for grounds it is not selective for short-circuits.

VENTILATION OF TURBO-GENERATORS.

Mr. R. B. Williamson, Milwaukee, presented a paper which dwelt upon the advantages of the thorough ventilation of turbo-generators and described the methods of ventilation found effective. The weight of ventilating air often equals that of the steam passing through the turbo units, and this air can be used for heating factory buildings. He pointed out the great desirability of using clean air, as a slight percentage of dirt may cause trouble. In a discussion of the paper, Mr. H. L. Wallau, of Cleveland, suggested the use of a vacuum cleaner to remove dirt from the generators, and Mr. Schuchardt said that such a vacuum system is being installed in a Chicago central station.

TRANSFORMER DEVELOPMENT.

Mr. H. O. Troy, Schenectady, presented a paper entitled "Recent Developments in Self-Cooled Transformers," which included a historical account of the development of this type. A method of cooling is described employing a boiler iron tank equipped with external tubes, and it is stated that transformer tanks having similar characteristics are now being built with compound corrugation. The brief discussion of the paper was confined to the proper definition of the term "radiation."

FINAL POWER TRANSMISSION SESSION.

At the final Power-Transmission session held on Friday morning there was a topical discussion on the operation of transmission system which was preceded by the presentation of a paper by Mr. H. A. Wagner, Baltimore, entitled, "Increasing the Flexibility and Reducing the Cost of Operation of Steam Boiler Plants by the Use of Fuel Oil," and a paper by Mr. George H. Walbridge, Denver, entitled, "Determining the Cost of Production in Steam Properties Under Varying Conditions."

BOILER FUEL OIL.

The paper by Mr. Wagner contained a description in outline of a boiler furnace arranged for combined oil and coal fuel.

Tests showed a gain in output of 66 2-3 per cent by the added use of oil, or a saving of 40 per cent in the cost of boiler equipment for a given output. This paper was discussed by Mr. M. C. Kennedy, Syracuse, who submitted a written communication, and Mr. W. L. Abbott, Chicago. Mr. Kennedy described the use by the Syracuse Lighting Company of oil for fuel in boilers held in reserve in case the supply of transmitted energy is interrupted. Mr. Abbott said that probably one ton of coal per day could be saved by using oil for banking fuel for a 500-kw boiler.

COST OF ENERGY FROM STEAM.

Messrs. Walbridge and Gilbert described certain charts for showing the factors which control the cost of steam energy, including size of plant, cost of labor, cost of fuel, evaporative efficiency of boilers and type of engine. There was no discussion relating specifically to this paper.

OPERATION OF TRANSMISSION SYSTEMS.

Written communications to the topical discussion were received from Messrs. Max. Hebgen, Butte; J. P. Jollyman, San Francisco, and R. S. Kelsch, Montreal. Mr. Hebgen outlined the features which tend to insure continuity of service, the most important of which he stated to be high insulation, great mechanical strength, good general arrangement and proper operation. He advocated the suspension type of insulator for all voltages above 20,000.

Mr. Jollyman described the ideal arrangement for generating apparatus, transmission line and substation equipments in order to minimize the number of interruptions and the length of time consumed in restoring service after each interruption.

Mr. Kelsch claimed that the insulation factor of safety in many systems now in operation should be increased by at least 200 per cent.

The discussion was continued by Messrs. W. N. Ryerson, Duluth; F. B. H. Paine, Buffalo; B. F. Pearson, Los Angeles; R. J. McClelland, New York; J. R. McKee, New York; G. H. Walbridge, Denver; E. L. West, Denver; R. G. Black, Toronto; P. H. Thomas, New York; N. J. Neall, Boston, and D. B. Rushmore, Schenectady.

Mr. Pearson called attention to the remarkable fact that in Southern California the inner petticoats of pin type insulators develop cracks, probably on account of the high temperature to which they are subjected. Trouble has also arisen from birds short circuiting the line to the steel cross-arms upon which they alight. Mr. West stated that the velocity of the wind at the highest altitude reached by the lines of the Central Colorado Power Company has been observed to be 165 miles per hour. Mr. Black said that during nine months the Niagara-Toronto 90-mile line operated without a single interruption to service; last month there were three attributed to lightning.

FOURTH COMMERCIAL SESSION.

The fourth commercial session was called to order in the main auditorium by Chairman John F. Gilchrist at 10.10 o'clock Friday morning. A large and enthusiastic audience was early on hand, and so much interest was displayed that the session was prolonged until 1.30 p. m.

ELECTRIC SIGNS.

The report of the committee on electric signs was presented by Mr. E. L. Callahan, Chicago, who announced that a bulletin on electric signs would be presented to each member of the session during the morning. Taking up the report he emphasized the importance of paying more consideration to the mechanical and artistic features of such signs, particularly to avoid trouble with the municipal authorities. A model sign ordinance was submitted. The committee advocated operating signs until at least 10 o'clock p. m. daily. No central station should supply energy to any sign presenting a serious fire risk. Electrical advertising to meet permanent success must be conducted on a dignified basis, avoiding the methods of the tinsmith. A suggestion was made that moving pictures be taken of animated signs for display at the next convention. The possibility of securing business from national advertisers were reviewed, and as a result of the work of the committee one large sign equipped with over 2000 lamps is to be placed in twenty-five cities.

The report was discussed by Messrs. E. A. Mills, New York; Frank Hammond, Birmingham; T. K. Jackson, Mobile; J. F. Gilchrist, Chicago; H. L. Parker, Baltimore; C. A. Littlefield, New York; and W. A. Johnson, Pittsburgh. Among the points brought out in the discussion were the facts that in New York an ordinance limiting the height of signs has been declared unconstitutional; and that sketches of prospective signs should be made and carried into effect under strict supervision, preferably by a responsible municipal officer. Diplomacy is needed in this work. Mr. Gilchrist favored paying a rental to cover the cost of inspection against accidents, which do the sign business great injury. The importance of securing lower freight rates on electric signs through appropriate action of the association was also mentioned. Mr. Littlefield cited the co-operation of the New York Edison Company with artistic organizations to the extent of even refusing to solicit sign customers on a particular street. Mr. Johnson pointed out that about 75,000 tungsten lamps are in service in Pittsburgh sign work.

COMPETITIVE ILLUMINANTS.

Chairman H. J. Gille presented the report of the committee on competitive illuminants, which was replete with valuable data for the lighting solicitor. The report constitutes one of the most exhaustive collections of anti-gas arguments which has ever been assembled, including comparative costs and a thorough discussion of service, inefficiencies and disadvantages. Considerable attention was given to the cost of operating pilot flames in connection with mantle lamps, it being shown that the gas consumption is increased about 30 per cent thereby. An inverted gas burner emits nearly 10 times as much heat as a 60-watt tungsten lamp. A very serious defect of the gas mantel lamp is its rapid depreciation of candle-power. A special section of the report dealt at length with the serious drawbacks and dangers of gasoline lighting installations.

The report was discussed by Messrs. S. W. Ashe, Harrison, N. J.; Norman Macbeth, Bloomfield, N. J.; L. H. Scherck, Newburgh, N. Y.; E. L. Callahan, Chicago; George S. Barrows, Philadelphia; Mr. Klumpf, Chicago; J. S. Codman, Boston; Thomas Hawkins, Rockland, Maine; George A. Sawin, Newark, N. J.; E. J. McCabe, New York, and Mr. Wagner, Brooklyn.

A wide difference of opinion appeared in the discussion concerning the report's accuracy. Messrs. Macbeth, Scherck and Barrows defended gas illumination, while Messrs. Callahan and Sawin spoke vigorously in behalf of the fidelity of the report to service conditions. In closing, Mr. Gille said that the values represent average practice and may be used with safety by the employees of commercial electric lighting departments.

ADVERTISING.

Mr. F. C. Lee presented the report of the committee on advertising, which furnishes an interesting exhibit of modern central-station publicity selected from all sections of the country. Over $2,000,000 per year is now being spent on central-station advertising, and it is probable that this will be increased at least 50 per cent within the next twelve months. Recent campaigns in Baltimore, Brooklyn, Philadelphia, Chicago, Mobile, Rochester, Milwaukee, Duluth, and other cities are included in the exhibits. Considerable attention has been paid in the report to advertising by public utility syndicates. The best opinion is that matters should be given a strong local tinge when distributed by a syndicate in different sections of the country. Adult thought and human interest, telling the reader something that is new to him, are vitally necessary. A feature of the report was the inclusion of several advertisements dealing with questions of corporate policy.

The report was discussed by Messrs. H. K. Mohr, Philadelphia; M. S. Seelman, Jr., Brooklyn; F. H. Gale, Schenectady; Douglas Burnett, Baltimore; J. Robert Crouse, Cleveland, and Vice-chairman George Williams. The principal points brought out by the discussion were a plan outlined by Mr. Gale, by which, upon central stations sending the names of people contemplating the erection of buildings to manufacturing companies, the latter will in turn send such parties special and general literature, describing electrical apparatus which may be profitably used by them; and the importance of closer daily co-operation between advertising and sales departments.

Vice-chairman announced at this point that the winner of the Crouse silver cup is Mr. Arthur S. Huey, Chicago, the victor having secured the largest number of new members for the commercial section.

FUNCTIONS OF A SALES DEPARTMENT.

The report of the committee on the functions of a sales department was presented by Mr. T. I. Jones, Brooklyn. It

discusses selling-force organization, credit in relation to new business, department bureaus and the compensation of salesmen. The partial-payment plan of wiring old houses was given high praise. The report advised selling apparatus at a profit. Power engineering questions were also taken up in considerable detail. The committee favored abandoning the plan of requiring deposits to be made in connection with new business. It was found that most companies are paying solicitors straight salaries. Salesmen should not be measured entirely by the volume of business secured. Where instalment wiring is required a commission for the salesman appears desirable.

The report was discussed by Messrs. B. W. Mendenhall, Salt Lake City; William H. Gardner, Lincoln, Neb.; S. M. Kennedy, Los Angeles; C. Duffy, Milwaukee; Douglas Burnett, Baltimore; E. W. Lloyd, Chicago; C. A. Littlefield, New York, and J. D. Israel, Philadelphia. In general, the persons taking part in the discussion favored the abandonment of the term "16-cp equivalents." The payment of straight salaries was also favored, although the combination of a salary and a commission was given some praise. Mr. Jones laid special stress upon the importance of paying good salaries to few men, rather than small salaries to many, and urged the merits of promotion from within the ranks. The importance of shortening the time elapsing between the signing of a contract and the turning on of the lights was also emphasized.

NOMINATIONS.

Mr. E. W. Lloyd, as chairman of the nominating committee, presented the following list of nominations for the ensuing year, which was unanimously accepted, after which the meeting adjourned:

Chairman, Mr. H. J. Gille, Minneapolis; vice-president, Mr. S. M. Kennedy, Los Angeles; secretary, Mr. F. B. Rae, New York. Executive committee, Messrs. Geo. Williams, New York; F. H. Gale, Schenectady; J. Robert Crouse, Cleveland; E. L. Callahan, Chicago; D. Campbell, Scranton; A. B. Rypinski, New York; E. W. Lloyd, Chicago; T. I. Jones, Brooklyn; Mr. Winter, Seattle; H. K. Mohr, Philadelphia; C. W. Lee, New York, and J. F. Becker, New York.

CLOSING GENERAL SESSION.

As chairman of the committee on the president's address, Mr. H. M. Byllesby, of Chicago, opened the third general session held in the Auditorium, Friday afternoon, and reported the thorough approval and appreciation felt by his committee in Mr. Freeman's official remarks.

PUBLIC UTILITY APPRAISALS.

Mr. Byllesby then presented his own paper, "Breadth of Vision in Public Utility Appraisals," in which, after remarking the obvious relation between appraised value and rates, he pointed out the difficulty of arriving at a fair estimate of actual plant values, reminding his audience that practically all structures or engineering undertakings invariably exceed the original allowances made by experienced builders and engineers. Such fixing of plant valuation requires the most conscientious application, he said, and as the difficult problems and complexities of electric service are better realized, Mr. Byllesby said he believed higher values would be allowed. The speaker also referred to the evident unjustness and lack of wisdom of reducing rates and income which might result in the restriction of future extensions. The principle of setting aside capital reserve against lean years, he said, has already been admitted and is, in fact, necessary to establish stable credit, insure fair employee's wages, and a proper reward for loyal workers.

Mr. Byllesby was followed by Mr. Insull, who urged plant managers to learn the actual values of their own properties, calling in outside expert assistance for this purpose. Such expert appraisals, said Mr. Insull, will usually result in divulging far higher values than previously suspected, and may be of the greatest importance in dealing with regulative bodies.

PLANT AND PROPERTY VALUATIONS.

A paper on "Elements Affecting the Fair Valuation of Plant and Property" was next presented by its author, Mr. W. F. Wells, who enumerated some of the factors to be considered in approximating original cost and reproduction values of actual property represented by fixed capital accounts. Mr. Henry Floy, of New York, referred to the confusion of terms of "wearing" and "service" values, and sought to distinguish between "theoretical" and "actual" depreciation. Mr. F. H. Peckham, of Providence, R. I., spoke of the difference in rates of depreciation under differing conditions. Mr. J. W. Lieb, Jr., referred to obsolescence and radical changes in types of machinery as affecting rates. Mr. Alten S. Miller, of St. Louis, said that certain regulative commissions have recognized the right of a company to earn a reasonable return while building up its business. He also advised the substitution of the term "non-inventory" property for "intangible" property in discussions before bodies unfamiliar with corporate accounting terms. Mr. H. C. Abell, of San Antonio, Texas, said that good management is often virtually penalized by public-service commissions in their efforts to determine reasonable returns. Mr. J. F. Klump, of Philadelphia, dwelt on the significance of going value, and referred to the principles adopted by the American Waterworks Association in which the physical plant is first assumed completely installed, and the cost of securing the business is then computed.

RATE RESEARCH COMMITTEE.

Mr. J. F. Gilchrist then submitted the report of the rate research committee, which advocated, so far as possible, the general establishment of more uniform rates throughout the country. While the committee was not unanimous as to the desirability of establishing a differential rate for residence use, it recommended the floor-area method as being the fairest, cheapest and most practical, easily understandable method of determining such a differential. A feature of the committee's report was an exhibit of models based on the three dimensions of kilowatt demand, kilowatt-hour consumption, and customer's bill, illustrating the rate schedules used in various cities. The use and development of this ingenious application of descriptive geometry was explained by the originator of the scheme, Mr. H. E. Eisenmenger, of Cleveland.

VARIABLE RATES.

"Some Reasons for Difference in Price for Different Services" was the title of a paper by Mr. Norman T. Wilcox, which, after a contrast of the difference between residence and commercial conditions, pointed out that here are certain natural discounts depending upon the size of the installation, cost of the equipment required, and hours' use of the service. The wide difference in basic cost is exemplified, for instance, in the possibility of selling 800 to 1000-kw-hours to residence service with an investment of $350 to $440 per kw of generator capacity, while with large motor service taking 3000 to 7000-kw-hours only an investment of $175 to $100, or even less, is required.

STANDARDIZING ELECTRIC SALES.

On account of the lateness of the hour, Mr. Douglass Burnett presented his paper on "Standarizing Electrical Sales" in abstract. Mr. Burnett advocated full publicity for central-station rates, suggesting that they be prepared in printed form and placed in the company's office so as to be equally accessible as the time-tables in a railroad office. He also proposed methods of figuring house-wiring, signs, etc., on a unit basis, so that immediate estimates might be quoted in reply to inquiries, without recourse to a contractor's inspection of the prospective job.

Mr. F. W. Smith, of New York, approved the idea of complete accessibility of rate schedules to the public, and declared that many persons now regarded such rates as obscure and difficult to understand.

SCIENTIFIC MANAGEMENT.

"The Possibilities for Economy in the Operation of Light and Power Companies by Scientific Time Study" were discussed by Mr. L. B. Webster, who presented his paper in abstract. Mr. Webster proposed and exhibited charts for comparing the output of certain classes of labor, and referred to the saving which can be made by giving proper instructions to

employees. The author showed how a certain gang of supposedly hard-working firemen under full-load conditions at the plant were found to be actually only 47 per cent occupied. In other instances, highly-paid men were found hiding their idleness by doing the work of cheaper labor. The engine-room, boiler-room and outside-plant department, said Mr. Webster, offer equal opportunities for improving the time-efficiency of the employees, in which the remainder of the crews should benefit from the elimination of the useless men employed in the gang.

In discussing the paper, Mr. H. Fitzjohn Porter, a professional efficiency engineer, said that while study has already been made of such operations as coal shoveling, as regards simple transfer of material, the procedure of firing a boiler to secure steaming efficiency involves so many variables that all conditions must be held constant, or misleading and worse-than-useless results will be obtained. Mr. Porter also pointed out that in making tests of labor possibilities, there is danger of carrying output to the point of over-fatigue, although the workmen might be unconscious of such effort.

NECROLOGY.

The report of the committee on memorials, which was presented by Secretary Martin, disclosed the loss of fourteen association members during the last year. The names of the following, with brief characterizations of their individual careers, were presented in the committee's necrology:

Stephen R. Bradley, Nyack, N. Y.; Rutherford D. Rubright, Brooklyn, N. Y.; Edward L. Brewster, Chicago, Ill.; Wallace G. Webber, Wareham, Mass.; Alex Henderson, New York; Albert Spies, Jersey City, N. J.; Theodore P. Bailey, Mount Airy, Philadelphia, Pa.; William H. Browne, Brooklyn, N. Y.; William C. Woodward, Providence, R. I.; Charles A. Vergin, Owatonna, Minn.; E. A. Beck, Los Angeles, Cal.; Frank S. Gorton, Chicago, Ill.; Robert D. Ferguson, Evansville, Ind., and L. J. Forget, Montreal, Can.

COMMITTEE ON RESOLUTIONS.

The report of the committee on resolutions was next presented jointly by its members, Messrs. Arthur Williams and T. C. Martin.

Resolutions of hearty thanks were expressed to the chairmen and members of the various committees who contributed to the success of the convention, including Mr. Arthur Williams, general chairman of the entertainment committee; Mr. F. W. Smith, hotel sub-committee; Mr. T. I. Jones, boat-ride sub-committee; Mr. H. E. McGowan, baseball sub-committee; Mr. C. G. M. Thomas, theatre sub-committee; Mr. Dudley Farrand, musicale and tea sub-committee; Mr. F. C. Bates, automobile sub-committee; Mr. J. W. Lieb, power-house visits sub-committee; Mr. J. E. Phillips, pumping-station sub-committee; Mr. H. M. Edwards, golf sub-committee; Mr. C. L. Law, secretary, and Mr. Walter Neumiller, treasurer of the entertainment committee.

The association also placed on record its appreciation of the courtesies and hospitalities received at the hands of the several member companies in the vicinity of the convention city—Flatbush Gas Company, New York and Queens Electric Light and Power Company, Northern Westchester Lighting Company, Peekskill Lighting and Railroad Company, Queens Borough Gas and Electric Company, Richmond Light and Railroad Company, the Bronx Gas and Electric Company, the New York Edison Company, the United Electric Light and Power Company, Westchester Lighting Company and the Yonkers Electric Light and Power Company, the Brooklyn Edison Company, and the Public Service Company of New Jersey.

To the Brooklyn Edison Company, the United Electric Light and Power Company and the New York Edison Company, the association's thanks were tendered for the services of employees, placed at the disposal of the secretary of the association to assist during convention week in the registration bureau, the distribution of advance copies of papers and the operating of the meeting rooms during the various sessions.

Other resolutions of thanks were passed as follows:

To President Freeman, Vice-presidents Gilchrist and Tait, and Treasurer Harries for their work of the year, with cordial compliments upon the condition of the association as it now enters upon its second quarter of a century.

To the secretary, Mr. T. C. Martin, and his loyal and efficient staff for the manner in which it has been sought to place promptly and efficiently at the disposal of every member the resources of the association in regard to the furnishing of data and information, the prompt handling of correspondence and the assistance to all the committees in their work.

To the association's sister engineering societies occupying the United Engineering Societies Building, which were most considerate and thoughtful, extending generous hospitality in every way.

To the superintendent of the Engineering Societies Building, Mr. Lambden, and his staff for their unremitting efforts in planning and carrying out arrangements which enhanced the success of the convention.

To the McGraw Publishing Company and to the entire editorial staff of the *Electrical World* for the *Convention Daily* issued during the week, the association placing on record its appreciation alike of the generosity and efficiency with which this service was rendered.

To the technical press for its loyal and efficient co-operation, and for the work and publicity which did much to make the convention so successful.

To the respective New York daily papers for generous and appreciative comment, and assistance to the association in its work and aims.

To Mr. J. C. McQuiston, chairman of the exhibition committee; to its secretary, Mr. Walter Neumuller, and to the individual members of the committee for the valuable and interesting collection of literature of Class D manufacturing companies, adding greatly to the educational value of the convention.

To Mr. Charles H. Hodskinson, master of transportation, for the efficient manner in which the important duties of his office were discharged.

To the Hotel Astor for the co-operation which made a success of the reception on Monday evening, May 29; the Hotel Waldorf-Astoria for the entertainment of the ladies on Thursday morning, and the Hotel Plaza for the tea and reception on Friday afternoon.

To President Brown, of the New York Central Railroad, for the use of its pier for the steamboat ride on Tuesday morning, and to President Bishop, of the Iron Steamboat Company, for the use of the Steeplechase pier for the sail on Tuesday night.

CONSTITUTIONAL AMENDMENTS.

Mr. Frank W. Frueauff, chairman of the constitutional amendment committee, presented his report outlining several skeleton plans of constitutions for company branches, technical and commercial sections, etc., and also proposing certain constitutional amendments, already submitted to the association during the executive session on Wednesday. On motion of Mr. Arthur Williams this report was accepted.

The report of the committee on overhead-line construction was also received by the association and matters in it pertaining to public policy referred to the executive committee. On motion of Mr. E. H. Davis, the subject of creating a bureau for receiving and dispensing information was referred to the executive committee.

ELECTION OF OFFICERS.

The nominating committee, comprising Messrs. J. W. Lieb, Jr., chairman; H. H. Davis, W. S. Hart, C. R. Huntley and R. F. Peck, then presented its report, embodying recommendations for officers as follows during the ensuing year:

President, Mr. John F. Gilchrist, Chicago.

First Vice-president, Mr. Frank M. Tait, Dayton, Ohio.

Second Vice-president, Mr. Arthur S. Huey, Oklahoma City, Okla.

Secretary, Mr. T. C. Martin, New York.

Treasurer, Gen. George H. Harries, Washington, D. C.

Members of the executive committee, Messrs. W. W. Freeman, Charles L. Edgar, Arthur Williams and H. H. Scott.

The report of the nominating committee was unanimously accepted and the convention cast a unanimous ballot for the officers above named.

When the newly elected president, Mr. Gilchrist, was escorted to the platform he received a rousing ovation from the floor of the convention, and President Freeman in conferring upon his successor the gold badge of the president's office predicted that Mr. Gilchrist's administration would mark, to date, the crowning success of the National Electric Light Association.

In accepting the honor of his election to the presidency Mr. Gilchrist graciously rejoined that he only hoped he might serve the association with some measure of the efficiency rendered by his predecessors in office.

There being no further business, President Freeman then declared the thirty-fourth annual convention of the National Electric Light Association adjourned.

THE PRESIDENT-ELECT.

Mr. John Foster Gilchrist, the president-elect, is assistant to the president of the Commonwealth Edison Company, Chicago.

John F. Gilchrist, President-Elect.

He is a native of Chicago, having been born there March 14, 1868. Mr. Gilchrist obtained his secondary education in the Chicago High Schools and later in the law department of Lake Forest University. He entered the service of the Chicago Edison Company as an office boy in 1887, and has been connected continuously with the company from that time. From 1894 to 1896 he was assistant to the manager of electrical sales, and in the year last named was made contract agent for the company. In 1906 he was promoted to be assistant to the president, a position he still occupies. Mr. Gilchrist has, however, other business interests, being secretary of the Economy Light & Power Company, of Joliet, Ill.; treasurer of the Federal Electric Company and the Federal Sign System, and second vice-president of the Illinois Valley Gas & Electric Copany. Mr. Gilchrist is an associate of the American Institute of Electrical Engineers and a member of the Illuminating Engineering Society, of which he has served as a director, and has read papers before technical societies on several occasions. He is also a member of the Union League, Chicago Athletic, Chicago Yacht, Homewood Golf and South Shore Country clubs in Chicago and the Industrial and Engineers' clubs in New York.

ENTERTAINMENT FEATURES.

There was probably a wider variety of entertainment provided for the delegates to the 1911 convention than at any other in the history of the National Electric Light Association.

The social features of the week began on Monday evening, May 29, with a reception to President and Mrs. W. W. Freeman, at the Hotel Astor. The many ladies and gentlemen present enjoyed an excellent musical program, which included an organ recital, orchestral music, and a promenade concert on the roof garden. Simultaneously there was dancing in the grand ballroom, interrupted for a collation served in the Orangerie of the hotel.

On Tuesday morning, there was a steamboat trip on the Hudson River as far as Tarrytown for the ladies exclusively. The day being a most clear and delightful one, the beautiful scenery on each side of the river was viewed at best advantage, the rugged Palisades, the well-kept estates, and the great stretches of woodland which greeted the eye fully sustaining the appellation, "The Rhine of America," so often applied to the Hudson. On Tuesday evening, members and their ladies were the guests of the Edison Electric Illuminating Company of Brooklyn for a steamboat trip down the East River to Steeplechase Park, at Coney Island. Over 1200 of those attending the convention took advantage of the opportunity to view the harbor at night, and found much pleasure in viewing the illumination of the three great bridges, in the picture presented by the flashing of a searchlight from the boat upon old Castle Williams, nestled amid the shadows of the army post on Governor's Island, the Statue of Liberty with its lighted torch in the Lower Harbor, and in Forts Hancock and Wadsworth at the Narrows. Here appeared in full view the magnificent illumination of Coney Island, in which was a great gap, filled hitherto by the brilliantly lighted "Dreamland," destroyed by fire on the night of Friday, May 26. Many in the party disembarked at Steeplechase Park to view the numerous attractions, after which the boat returned to New York with those who preferred the water to the rail route.

Heavy rain made it necessary to cancel the ball game between teams from the Brooklyn and the Philadelphia companies which was to have been held on Wednesday afternoon, and owing to the necessity to adhere to the schedule it proved impossible to find other time for this popular event. The contest was to have been the first for a cup donated by the Westinghouse Electric & Manufacturing Company.

On Thursday morning there was a costume musicale for the ladies at the Waldorf-Astoria, and in the evening members and their guests attended the theatre as guests of the association. The choice lay between "Everywoman," at the Lyric Theatre; "The Henpecks," with Lew Fields, at the Broadway and a variety show at the Winter Garden. This was one of the most successful events at the convention and the large audiences were most enthusiastic over the performances and the many quips and jests on the electrical industry which were interspersed among the regular lines.

The entertainment provided for Friday included an automobile for the ladies throughout the upper sections of the city. There were over forty automobiles in line, each decorated with flags bearing the insignia of the association. The ride lasted nearly three hours and covered many places of interest in the residential districts and in the parks. In the afternoon there was a tea at the Hotel Plaza for the ladies, and at 6 o'clock in the evening the Sons of Jove held a dinner and rejuvenation at Reisenweber's Casino, Coney Island.

The concluding event of the week was a boat trip on Saturday at which the members and ladies were the guests of the New York Edison Company. Visits were made at the generating stations of the company, at those of the Interborough Rapid Transit Company, and at the works of the Consolidated Gas Company. Luncheon was served aboard, and a concert was given throughout the trip by an excellent orchestra.

Provision was made during the week for members who desired to play golf, and in addition to the interesting events on the program, the visiting ladies enjoyed many shopping and sightseeing trips in company with an official chaperon.

The work of the members of the entertainment committees was most efficient in every detail. Credit is due them in a large measure for their part in making a success of the 1911 convention. Members and their guests were entertained in a most comprehensive manner, and the excellence of trips arranged afforded opportunity for both out of town delegates and those from New York and vicinity to gain a lasting impression of the magnitude of New York City and its environs.

Convention Notes.

One of the pleasant features of the convention was the presentation of a portrait of Miss Harriet Billings, assistant secretary and treasurer of the association. The portrait was presented by Mr. W. C. L. Eglin in the name of Mr. H. L. Doherty, who had intrusted the commission for the portrait to Miss Peterson, a well-known artist. In presenting the portrait, Mr. Eglin referred to the great service of Miss Billings to the association, which dated from 1891. During the greater part of the period Miss Billings was practically in charge of all the routine work of the body, and in addition was editor of the *Transactions*. She also greatly assisted the work of the committees, and performed much executive work of various natures. The labor of editing the *Transactions* alone was very great, as it was the ambition of Miss Billings to leave the record in a literary form that would compare favorably with the *Transactions* of professional societies. Mr. Eglin referred to the faculty of Miss Billings of inspiring confidence and enthusiasm among the members in the work of the association. Her many sacrifices and unselfish work should, he said, always be remembered with the deepest gratitude and appreciation. Mr. Samuel Insull, in seconding a motion to appoint a committee to send to Miss Billings an expression of the high appreciation of the members of the association for her activities in the past, said that any one who has been president of the association in its early days knows full well the great service rendered by

Portrait of Miss Billings.

Miss Billings, and added that it was a pleasant thought on the part of Mr. Doherty to present to the association the portrait of one who had labored so faithfully in its interest.

NEW YORK EDISON BAEDEKER.

A New York Baedeker ("Glimpses of New York'), distributed at the convention by the New York Edison Company, was not only highly appreciated by all for the useful information it conveys, but by book-lovers among the attendants who were fortunate in obtaining a copy will be valued and preserved as a beautiful specimen of the book-making art. In general design, binding, paper, typography, and illustration, the little volume of about 150 pages is certainly unique as a production for ephemeral use. The numerous artistic illustrations, which include several excellent etchings, have their full value brought out by the manner in which they are printed and by the character of the type page. The little book well deserves preservation in permanent binding as a most tasteful production of the book-designer and printing press.

BULLETIN BOARDS.

The arrangements provided for keeping members in touch with proceedings at parallel sessions and for notifying members who were wanted on the telephone left nothing to be desired. The auditoriums were equipped with telephone and bulletin board service, by means of which the name and subject of each speaker were continuously displayed at the front of the hall. The bulletin was changed as rapidly as the papers and committee reports were altered in any particular session so that a person so desiring could leave one session to attend another, at which some paper in which he was interested was about to be presented. Persons desired on the telephone were apprised of this fact by having their names flashed on the wall by a stereopticon.

ELECTRIC VEHICLE LUNCHEON

At the close of the second commercial session on Thursday afternoon electric vehicle manufacturers and their agents were tendered a luncheon at the New Grand Central Palace by Mr. Arthur Williams, of the New York Edison Company. A number of vehicle men were present at the convention, and embraced the opportunity for an informal talk after the report of the committee on electric vehicles. A secondary purpose of the meeting, as explained by Mr. Williams, was to give the manufacturers an opportunity to inspect New York's latest and largest show place. About forty gentlemen were present at the luncheon, which was prepared entirely by electric heat.

EXCURSION TO POWER PLANTS.

As the concluding feature of the convention the New York Edison Company arranged a steamboat ride on the Hudson and East rivers Saturday, with stops at the Astoria plant of the Consolidated Gas Company and the Interborough Rapid Transit Company's station on West Fifty-ninth Street. The party was scheduled to leave Waterside Station No. 2 on the steamer *Majestic* at 11 o'clock. Luncheon was to be provided and an orchestra to entertain the ladies who did not wish to embark and go through the fatigue of inspecting the power houses.

REJUVENATION OF THE SONS OF JOVE.

About 500 members of the Sons of Jove held an annual rejuvenation and dinner at Reisenweber's Casino at Coney Island Friday night, initiating 125 novices. The dinner began at 6 o'clock, the members arriving by boat, train and special automobiles. Mr. T. I. Jones presided at the dinner, at which Messrs. W. W. Freeman and J. F. Gilchrist were guests of honor. Mr. J. F. Dostal, of Denver, the reigning Jupiter of the order, presided at the exercises, which were scheduled to begin at 8 o'clock. The original arrangements for the dinner and rejuvenation were made for Dreamland, Coney Island, but the destruction of the famous park by fire necessitated a change at the last minute. The Sons of Jove has a membership of almost 8000.

SPECIAL TRAINS.

Special trains bearing members and the guests to the convention arrived in New York Sunday afternoon and Monday. The largest trainload came from Chicago Monday morning with 134 persons aboard. It ran as a second section of the New York Central's Twentieth Century Limited, leaving Chicago at 2:40 p. m. Sunday and arriving in New York at 10:50 the following morning. A special car was added to the train at Cleveland and a stop of twenty minutes was made at Elkhart, Ind., to enable a group photograph to be taken. The arrangements for the train were in charge of G. A. Freeman, of the Commonwealth Edison Company, who acted as assistant master of transportation. The longest special trip was that made by the St. Louis party, who occupied a couple of special cars attached to the Pennsylvania Railroad twenty-four hour New York. The party left Union Station, St. Louis, at 12:20 p. m.

Saturday, reaching New York at precisely 1:20 p. m. Sunday. Several convention delegates from Illinois and Indiana points joined the party en route. The arrangements of the train were in charge of Mr. F. N. Jewett, of St. Louis, who acted as assistant master of transportation. A number of Bostonians journeyed to New York Sunday evening by boat, coming on the *Commonwealth* of the Fall River line, which, touching at Providence, took on several local electrical men, thus bringing in a party of forty. Another New England contingent of thirty followed Monday morning on the Bay State, Limited, from Boston.

BASEBALL TROPHY.

A very handsome three-handled silver loving cup lined with gold and standing nearly 12 in. high was presented to the association by the Westinghouse Electric & Manufacturing Company as a baseball trophy to be contested for by amateur company teams each year during the annual conventions. The design is by Tiffany. Engraved on the exterior of the cut is the following inscription: "Westinghouse Cup, presented by the Westinghouse Electric & Manufacturing Company to the National Electric Light Association (here follows the association symbol), to be competed for at annual conventions by baseball teams composed of members of the association and to be held in trust at association headquarters. MCMXI." The teams of the Brooklyn Edison and Philadelphia Electric companies were to compete for this trophy at the baseball grounds in Brooklyn on Wednesday afternoon, but owing to rain the game was abandoned, so that the first contest for the cup must be held at some future date.

Silver Baseball Trophy.

COMMERCIAL SESSION BANQUET.

One minute before midnight on Thursday a banquet was given at the Hotel Martinique to the officers, committee chairmen and committee members of the company section of the N. E. L. A. The masters of ceremonies were Messrs. J. R. Crouse and George Williams. Speeches were made by Messrs. Freeman, Gilchrist, Tait, Martin and others. The event of the evening was the announcement of the award in the membership contest, a silver loving cup having been donated by Mr. Crouse to the person who obtained the largest number of new members. The cup was won by Mr. A. S. Huey, of H. M. Byllesby & Company, Chicago, who had obtained 107 new members. Mr. George Williams, of H. L. Doherty & Company, made a close second with 106 new names. The cup was presented by President Freeman, and Mr. Huey, who was detained at home because of illness, was represented by Mr. E. S. Callahan.

ANNUAL MEETING OF CLASS D MEMBERS.

At 12:30 Thursday afternoon about fifty Class D members held a meeting in the summer garden arranged in the passageway east of the lobby. Mr. J. C. McQuiston presided, and Mr. Walter Neumuller, secretary-treasurer, read the minutes of the last meeting and presented his report. Mr. McQuiston referring to the convention in Seattle next year called upon Messrs. C. Blizzard, W. M. S. Miller, F. H. Gale and H. M. Wilson for a discussion as to the advisability of holding an exhibit on the Pacific Coast in 1912. Mr. McQuiston stated that there were excellent facilities for this purpose available in Seattle and those who spoke on the subject felt that the convention offered an opportunity of introducing many manufacturers to a new circle of friends and purchasers in the extreme Northwest. Messrs. F. H. Gale, C. W. Price and H. W. Young were appointed as a committee on nomination for members of the exhibition committee to succeed Messrs. J. I. Ayer, C. Blizzard and H. G. McConnoughy. The nominating committee recommended that the terms of the outgoing members of the committee be extended, and this recommendation met with unanimous approval.

CONVENTION DAILY.

One of the features of the convention was the *Convention Daily*, issued for the National Electric Light Association by courtesy of the *Electrical World* on Tuesday, Wednesday, Thursday, Friday and Saturday of the convention week. The entire staff of the *Electrical World* was placed at the disposal of the association, which was relieved of the entire expense and work incident to the issuance of a publication of this kind. The proceedings and incidents of each day were chronicled in the issue appearing the following morning at 6 o'clock. The paper was distributed to members registered at hotels and to all others attending the convention. The smallest issue contained twenty-eight pages the size of that of the *Electrical World*, and the largest issue contained thirty-six pages.

CURRENT NEWS AND NOTES.

Ceremonious Opening of Electric-Lighting Offices.—Elaborate preparations were made for the exercises connected with the opening of the brilliantly lighted offices of the Bristol (Tenn.) Gas & Electric Company on May 18. The company held a reception which is said to have been the most effective affair of the kind ever held in Bristol. The building was outlined with electric lamps forming a flaming sign that will be retained as a permanent feature of the illumination. The president of the company is Mr. H. L. Doherty; the general manager and chief engineer is Mr. S. M. Vance.

Reputed Fire Extinguisher Itself Inflammable.—Carbon tetrachloride, which has been recommended as a valuable fire extinguisher for use in telephone exchanges, power houses and other electrical installations on account of its non-conducting properties, is declared by chemists familiar with the material to be itself inflammable, assisting rather than retarding combustion. Carbon tetrachloride is said to decompose at 550 deg. Fahr., burning with a blue flame and liberating pure chlorine gas, which is very poisonous. In a closed room this gas would probably suffocate any one attempting to use the tetrachloride before the fire could be extinguished.

Concrete Houser Lake Dam in Service.—As described in our issue for April 25 and May 23, 1908, the iron framework of the Houser Lake dam on the Missouri River near Helena, Mont., was destroyed by a flood on April 14. The iron dam has now been replaced by a reinforced-concrete structure 600 ft. in length by 130 ft. in maximum height, 110 ft. in maximum width at the bottom and 20 ft. in width at the top; the foundation is laid 65 ft. below the bed of the river. The dam, which is being placed in service during the present month, is the property of the United Missouri River Power Company, Helena, Mont., which has taken over the Helena Power Transmission Company, for which the iron dam was constructed. The president is Mr. S. T. Hauser and the general manager Mr. H. M. Gerry.

University of Nevada.—The Nevada State Legislature has appropriated $40,000 to purchase additional electrical equipment for the University of Nevada at Reno, the purpose being to make the electrical course there one of the strongest in the West. Prof. J. G. Scrugham is in charge of the electrical engineering department.

Free Telephone Service Illegal in Pennsylvania.—The Pennsylvania State Railroad Commission, which has jurisdiction over telephone companies, declared illegal and unlawfully discriminatory the practice of giving certain periods of free telephone service in consideration of contracts for a longer period of service at the standard rate.

Canadian 100,000-Volt Transmission System.—The Shawinigan Water & Power Company, which operates an 80-mile, 30-cycle system transmitting energy at 50,000 volts into Montreal, has begun work on a duplicate three-phase steel-tower line from Shawinigan Falls to Montreal to be operated at 100,000 volts. The new line will parallel the old line at a distance of about 10 miles.

Electrical Engineering at Clemson College.—It has been decided to discontinue the electrical engineering course at the University of South Carolina, Columbia, and those desiring to take up the study of that branch will be referred to Clemson College, which will be the only state institution conducting a professional electrical course. There have been fifty-eight graduates from the university's electrical engineering course.

To Investigate Corona Losses in Transmission Lines.—Experimental sections of high-tension transmission lines are being constructed on Stuart Field at Purdue University, Lafayette, Ind., to study the corona losses occurring under conditions of high potential. A steel and a wooden pole line are being erected, the latter arranged with movable insulator pins so that the distance between wires may be varied. These transmission lines will be excited from the 300,000-volt transformer in the electrical-engineering laboratory at Purdue.

Railway Signal Association.—The summer meeting of the Railway Signal Association will be held at the Hotel Astor, New York, June 13-14. Reports will be submitted by twelve standing committees and several special committees. Among the papers to be presented is one by Messrs. W. K. Ferguson, R. E. Russell and E. E. Kimball on "Apparatus for Charging Storage Batteries." An important matter to be considered at the meeting will be the subject of signal symbols. Mr. C. C. Rosenberg, consulting signal engineer, Bethlehem, Pa., is the secretary.

Underground Conduits for Montreal.—A commission has been appointed to determine details of the municipal electrical circuit conduits to be constructed by Montreal in accordance with a charter amendment which authorizes the construction, administration and maintenance of a system of underground conduits to carry all electrical circuits. The commissioners appointed are: Mr. R. S. Kelsch, consulting hydroelectric engineer, representing various electrical companies operating in Montreal; Mr. Beandry Leman, manager of the Canadian General Development Company, representing the city of Montreal, and Prof. Louis A. Herdt, of McGill University, representing the Quebec Public Utilities Commission.

A. I. E. E. Visit to McCall's Ferry Plant.— On Sunday, May 21, members of the Washington and Baltimore Sections of the American Institute of Electrical Engineers, the Washington Society of Engineers and the Engineers' Club of Baltimore, aggregating more than 190 men, were carried on a special train to Holtwood, Pa., where they inspected the large hydroelectric plant of the Pennsylvania Water & Power Company. Four units, three of 7500-kw and one unit of 10,000-kw rating, have been placed in operation, and the fifth unit is now being installed. Mr. John Abbet Walls, chief engineer of the company, assisted by a number of other officials and employees, took the excursionists over the plant and explained in detail its numerous interesting features.

Merger of Chicago Elevated Roads.—The elevated railway companies of Chicago, through their directors, have agreed to the terms offered by Mr. Henry A. Blair for the merging of the overhead routes, and the consolidation of the roads will follow as soon as the stockholders ratify the action of their directors, which is confidently expected. The South Side Elevated Company has accepted the offer of $75 a share for its stock, allowing dividends of cash on hand above liabilities to be returned to its stockholders. The merger terms have also been accepted by the Metropolitan West Side Elevated and the Northwestern Elevated companies, the latter of which controls the Chicago & Oak Park Elevated Railway and also owns the Union Elevated Loop. June 15 has been set as the date of the transfer. After the plans of the elevated-lines merger have been worked out and are in effect, it is expected that the pending merger of the surface lines with the elevated routes will also be consummated. This deal will involve a total of $271,000,000 of existing securities of Chicago transportation properties.

Minneapolis Electric Show for 1912.—Plans have already been formulated for the Minneapolis Electric Show to be held March 16 to 23, 1912. In addition to the Electric Show proper a mechanical and industrial exposition is to be given, a feature of which will be a special exhibition of commercial and pleasure electric vehicles. The 1912 Minneapolis show will be given under the auspices of the Northwestern Electric Show Association, the officers of which are: President, Mr. Fred G. Dustin; vice-president, Mr. H. J. Gille; secretary, Mr. Walter Stevenson, and treasurer, Mr. A. W. Leonard. The directors are Messrs. George Cadwell, C. D. Wilkinson and Theodore Hayes. Mr. Robert W. Clark has been again chosen as general manager of the exposition. The meeting of the Minnesota Electrical Association will be held in Minneapolis at the time of the Electric Show, and there are also to be other important electrical sessions, among which will be the Northwestern meeting of the American Institute of Electrical Engineers under the auspices of the local branch. Realizing the educational advantages of the show, the Minneapolis Commercial Club has arranged to award prizes for electrical apparatus made by students.

Ithaca A. I. E. E. Annual Dinner.—The Ithaca Section of the American Institute of Electrical Engineers held its fourth annual dinner Wednesday evening, May 24, at which over 100 members were present. Prof. E. L. Nichols, head of the department of physics, was toastmaster. The guest of honor was Mr. P. M. Lincoln, chairman of the sections committee of the A. I. E. E. Mr. Lincoln gave a short address, taking as his subject "Looking Forward." Prof. Vladimir Karapetoff, who gave a talk in behalf of the unsuccessful student, caused much amusement by his witty remarks. Mr. W. M. Alexander, of the General Electric Company, who happened to arrive in Ithaca that evening, made a few remarks on the relation that should exist between the colleges and manufacturers in the education of young engineers. Several novel features were introduced during the evening. Among them an electrical "stunt" was very successful. As the guests entered they were forced to pass between two small cedar trees placed so that they brushed against them. The trees were connected to the terminals of a 30,000-volt static machine operated by a small motor. No wires were required on the trees since the fresh wood made a sufficiently good conductor. The shock was not heavy enough to be unpleasant, but caused some surprise and gave amusement to the guests who had previously passed through.

NORTHWEST STATION, CHICAGO.

Commonwealth Edison Company's Generating Plant, with 20,000-kw Units, Now Building.

IN his annual report dated Sept. 30, 1910, the president of the Commonwealth Edison Company, Chicago, made this brief statement: "In order to take care of the company's continued increase in business your directors have acquired 112 acres of land on the North Branch of the Chicago River, north of Belmont Avenue, for the purpose of building thereon a central power plant which will have an ultimate capacity of 360,000 hp. Work on the first section of this plant is now in progress, and it is expected that 60,000 hp of machinery will be installed and in operation by next autumn."

This official announcement by Mr. Samuel Insull refers to perhaps the largest electric generating station now under construction, which has several features of particular interest and significance. The *Electrical World* of March 17, 1910, contained the anouncement of the building of this station, with a general forecast of the manner in which it would be constructed. The plans have been changed to some extent since that time, but the map of Chicago and vicinity then given, showing the relative location of the new station, may be consulted in connection with the present article, which is intended to give a brief outline description of the plant at a time when the work is well advanced toward completion.

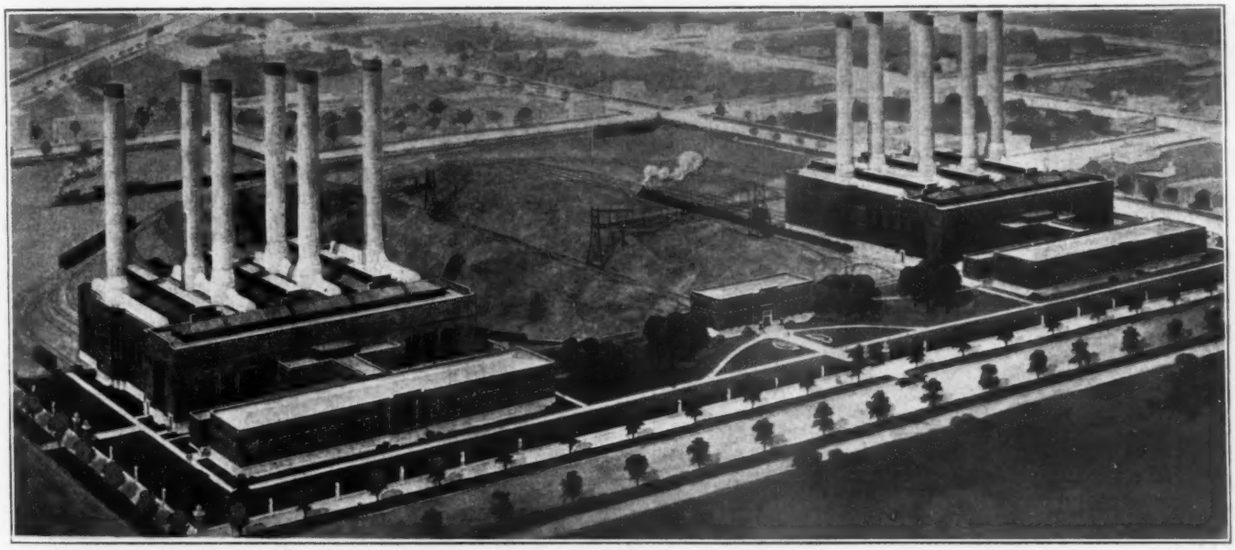


Fig. 1—Northwestern Station, Chicago, Showing Twin Power Houses as They Will Appear When Completed.

Unceasing growth is a characteristic, of course, of successful electric-service companies. It is interesting to recall that at the time of the Chicago convention of the National Electric Light Association in 1903 the Fisk Street station of the Commonwealth Edison Company (or Commonwealth Electric Company, as it was then) was under construction. Five years later, when the association met again in Chicago, the later Quarry Street station, near neighbor to "Fisk Street," was building, and now, after a lapse of three years, the association is meeting at a time when a greater station than either is under construction in Chicago—a station to have when completed twice the rating of the famous Fisk Street plant.

The present generating rating of the Commonwealth company is about 240,000 kw, divided as follows: Fisk Street, 120,000 kw; Quarry Street, 84,000 kw; miscellaneous plants and storage batteries, 36,000 kw. At the new Northwest site there will be ultimately two stations of 120,000 kw rating each, making a total of 240,000 kw on this site, or 480,000 kw in all. Fig. 1 is an architect's perspective of the twin Northwest stations as they will appear when completed. The remarkable growth of the company's business is indicated by the figures given. The demand for electricity increases steadily with the growth of Chicago, improved engineering to reduce the cost of the output and modern methods of merchandising to demonstrate the logic of central-station service for all classes of electrical demand. The total maximum demand on the stations last winter was 184,000 kw, which, compared with the maximum rating of 240,000 kw (including storage batteries), shows that, to preserve the margin of safety, the need of further extensions with the constant growth of the company is a real one.

GENERAL ARRANGEMENT AND METHODS.

Work has been under way for over a year on the site of the new stations. Only a portion of one of the twin plants is under construction at the present time, but, as shown by Fig. 2, the initial station equipment is itself very large. The station now under way will contain ultimately six 20,000-kw turbo-generators. The initial-equipment installation will consist of two of these units, or one-third of the ultimate equipment of the station. In order to effect economy in construction, however, more than one-third of the completed station is being built at the present time. For instance, the turbine-room is provided with an operating gallery forming a bay at one side of the room and equidistant from the ends of the completed room, as shown in the general-arrangement plan, Fig. 3. The portion of the turbine-room now building will include this bay for the operating gallery complete, so that about two-thirds of this particular portion of the plant is under construction at the present time. It may be said, perhaps, that nearly one-half of the ultimate first station is now under construction, although the initial rating will only be one-third of the completed station.

As stated by Mr. Insull in his annual report, the site of the new Northwest station embraces 112 acres of land. This site consists of two large portions, with a wide connecting strip. One of these borders on the North Branch of the Chicago River and in general terms is bounded by West Addison Street on the north, the river on the east, West Roscoe Street on the South and North Sacramento Avenue, North Whipple Street and Elston Avenue on the west. This portion of the site contains fifty-three acres, and is the actual site of the new generating station. West of it is another large area, bounded by West Addison Street on the north, North Kedzie Avenue on the east, West Roscoe Street on the south and North Kimball Avenue on the west. This is contiguous to the Chicago & Northwestern Railroad tracks, and may ultimately be used in part for switch tracks and coal storage. Connecting these two portions is a strip of land 150 ft. wide, and on this strip has been built a two-track elevated railway to be electrically operated, forming

a spur line connecting the Chicago & Northwestern Railroad tracks with the station. Coal will be delivered over this elevated railway. Fig. 8 is a map of the property showing elevated railway.

The cable distance from the new Northwest station to the center of the downtown district will be about 6 miles, which is substantially the distance in an air line. The cable distance between the Northwest station and the Fisk Street station will be about 8 miles. Northwest station, like other large generating stations, is essentially a great manufacturing plant. Coal is brought from the west over the company's own elevated railway, and water is brought from the North Branch of the Chicago River at the east, a much shorter distance to the generating station. From these raw materials electricity is manufactured and distributed. The handling of the coal is a very important item in a large modern steam central station, and careful attention has been paid to it at this new location.

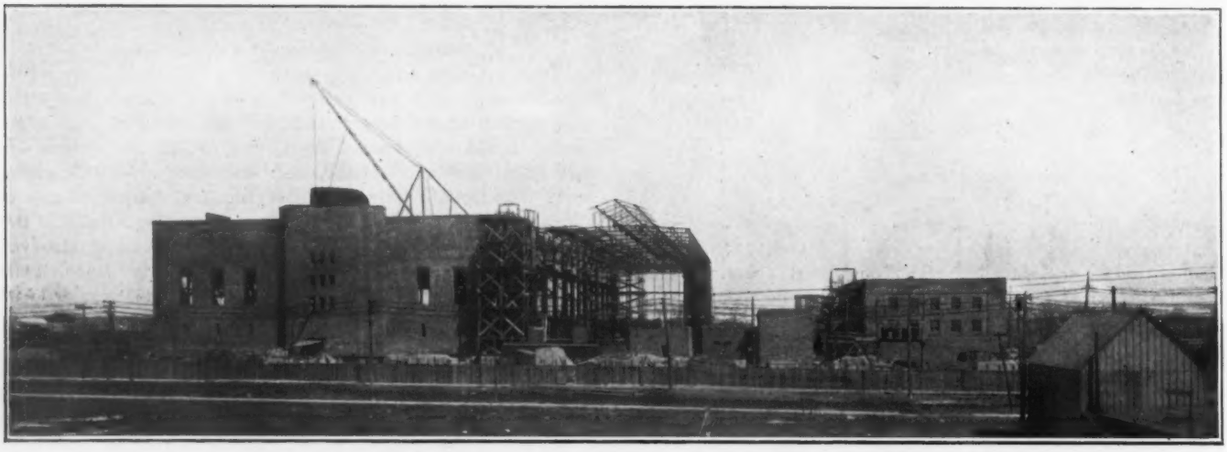


Fig. 2—Northwest Station, Chicago, at the Present Time Under Construction.

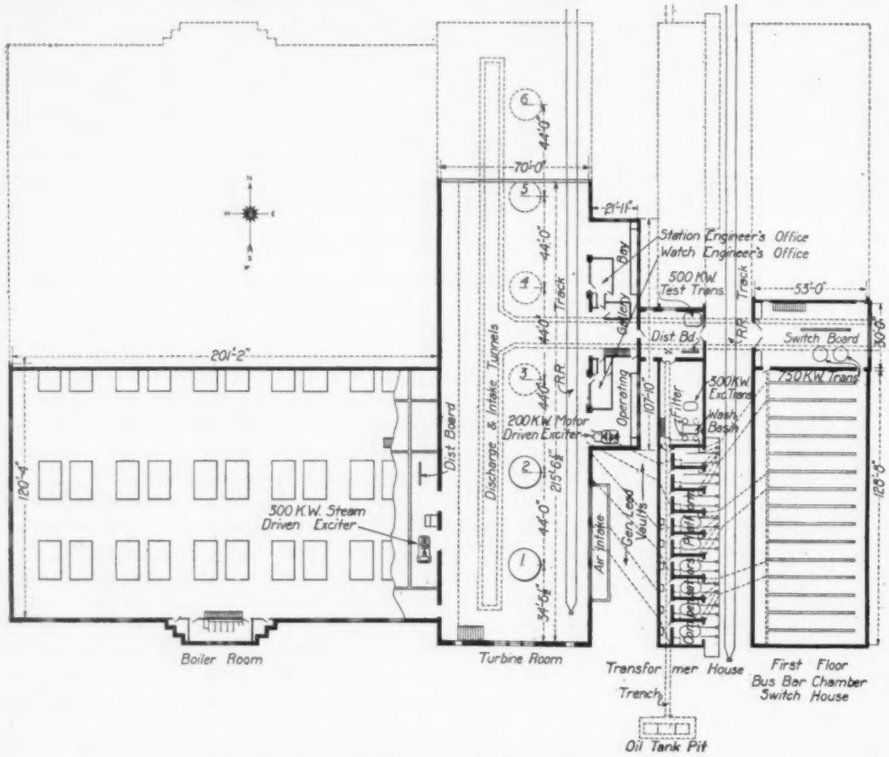


Fig. 3—General Arrangement Plan of First Floor.

THE ELEVATED RAILWAY AND THE EMBELLISHMENT FEATURES.

The territory in which the Northwest station is built is thickly settled only in spots, but the company is making every effort to make the new institution not only a great addition to the neighborhood in an industrial sense, but also, in many ways, an improvement in esthetic conditions. The elevated railway, which is about 4000 ft. long, is very thoroughly built, and is provided at five street crossings with substantial yet attractive steel bridges.

As shown in Fig. 8, the railway is laid out in switchback fashion west of the two power houses, as they will exist eventually. This portion of the railway, inside the eastern grounds of the company, is at grade. The switchback is arranged to provide a smooth and easy descent for the loaded coal cars coming from the elevated portion and also permit of the taking off of switch tracks in an advantageous manner. Including the switchback, there will be over 3 miles of track on this railway. It is owned and operated by the Commonwealth Edison Company, using, eventually, 600-volt direct current. The third-rail system will be used to supply energy to electric locomotives which will haul the coal cars.

An important feature of the Northwest station is the care taken to make it attractive. The company is going to considerable expense to make the institution something of which the people living in the neighborhood will be proud. On the railway right-of-way houses have been moved, and in relocating them the company has also repaired and improved them. The sides of the elevated structure will be sodded, and all about the plant when completed there will be attractive fences and ornamental lighting systems.

Particularly elaborate is the beautification proceeding at the corner of Elston Avenue and West Roscoe Street. Here two frame houses that existed on the property have been remodeled for the company's uses, one serving for offices and the other as a restaurant, and the grounds about them are being sodded and set out with flowers, shrubbery, etc., and provided with winding cement walks. When completed the appearance of this corner of the property will be no doubt the most attractive, park-like feature of the neighborhood, and the pains the company is taking in this matter in-

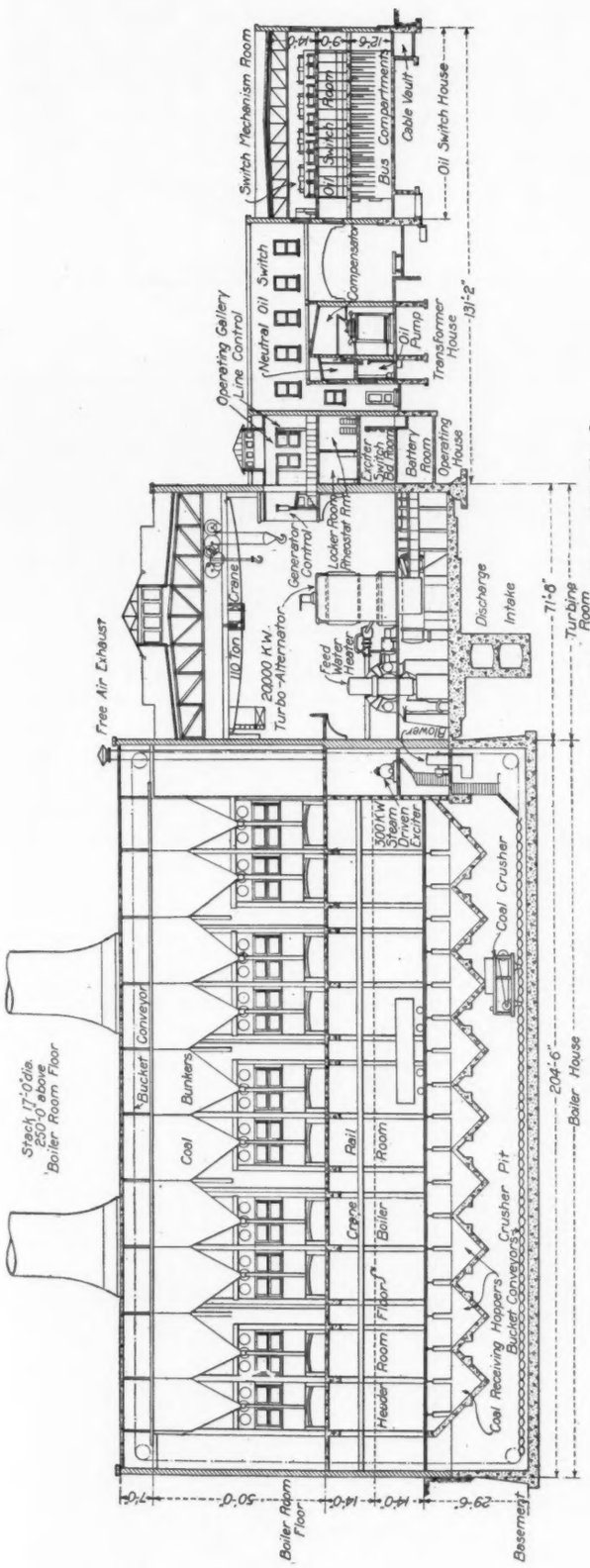


Fig. 4—Sectional Elevation of Northwest Station, Looking North from Unit No. 2.

dicate forcibly a comparatively new conception of what a central-station company owes to its neighbors in beautifying its property. It is hoped that people living in the vicinity will look on the new station as no undesirable intruder.

STATION CHARACTERISTICS AND DIMENSIONS.

As indicated in Fig. 3, Northwest station consists essentially of four parts in three distinct buildings, yet so connected as to form a compact and conveniently arranged whole. Referring to the general arrangement plan and sectional elevation it will be seen that the four portions of the plant are the boiler house, the turbine-room, the transformer house and the switch house. The station now under construction is near the corner of West Roscoe Street and North California Avenue, and the greater dimension of the station is from east to west, or parallel with West Roscoe Street. The station group is 411 ft. long—that is, from east to west—and when completed will be 294 ft. 5 in. wide—that is, from north to south. The turbine-room, transformer house and switch house have their major axes from north to south, but the rows of boilers in the boiler house will extend at right angles to the turbine-room or from east to west. The inside dimensions on the four sections of the plant, from east to west, are as follows: Boiler-room, 201 ft.; turbine-room, 70 ft. (operating gallery of turbine-room, 22 ft.); transformer house, 20 ft.; switch house, 53 ft. North and south the turbine-room is being built now for a length of 218 ft. As previously explained, the other parts of the station are not being extended as far as this at the present time. The north wall of the present station is of a temporary nature, to be taken out as extensions are made.

The buildings are of steel-frame construction, with outer walls of hard-burnt red paving brick. The foundations, basement walls, coal-receiving hoppers, cribs and tunnels are made of reinforced concrete. The architectural design of the building exteriors is simple and massive, but is relieved by a number of panel designs in courses of brick.

COAL-HANDLING AND BOILER-HOUSE DESIGN.

Considering first the boiler house at the west, and referring to Figs. 4 and 5, it will be seen that a large proportion of the coal is handled under the boiler-room floor. This makes for greater ease and convenience in handling and does not require such heavy steel construction for overhead hoppers. There is no train shed, as is the case at Fisk and Quarry Streets, the basement of the boiler house answering that purpose. Four railroad tracks enter this basement at present, two being used for the delivery of coal and two for the removal of ashes. As there are four boiler-house railroad tracks for each pair of generating units, there will be twelve in the completed station.

The coal-handling arrangement is notably simple and effective. The coal is brought into the basement by electric locomotives hauling the coal cars in which it is delivered. It is there dumped directly into coal-receiving hoppers or handled by an overhead coal crane in case of cars without hopper bottoms. From these receiving hoppers the lump coal is run through a traveling coal crusher which is provided with a by-pass for the fine coal. The crushing machinery is in a deep pit, as shown in Fig. 5, while the boiler-room floor, as shown in the longitudinal section, Fig. 4, is on a comparatively high level, being, in fact, on the same level as a gallery in the turbine-room, enabling the boiler-room operating engineers to obtain a survey of the entire turbine-room from this somewhat elevated position.

From the coal crusher the fuel is discharged into a coal conveyor which takes it to overhead bunkers over the firing space, whence it is spouted into the mechanical stokers of the boiler furnaces. The removal of ashes is accomplished simply by dumping the ashes from the furnaces directly into cars placed on the ash-removal tracks beneath the ash pits of the furnaces. Coal-storage space is provided in the yards to the extent of 150,000 tons for each station. Spanning each of these coal piles will be an electrically operated gantry crane with 265-ft. span. In addition, the storage capacity of the receiving hoppers beneath the boilers is 74 tons for each boiler, while the capacity of the overhead bunkers is 63 tons for each boiler.

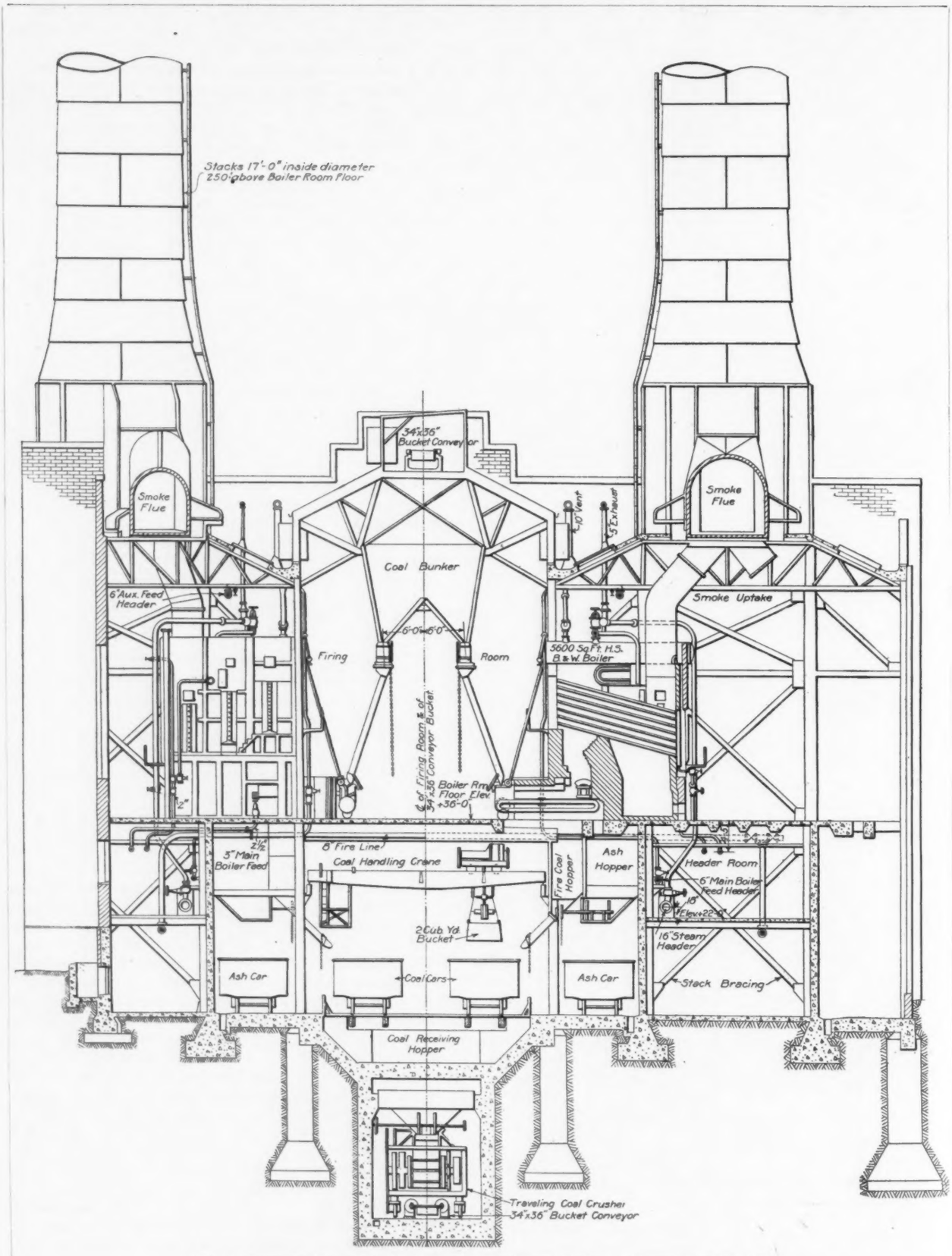


Fig. 5—Cross-Section of Boiler-Room of Northwest Station, Chicago, Looking West.

Ten boilers are provided for each 20,000-kw unit, the boiler lanes running east and west and at right angles to the major axis of the turbine-room, which is north and south. Each boiler has 5600 sq. ft. of heating surface and is inclosed in a sheet-steel casing. The boilers are equipped with chain-grate stokers and the ten boilers for each unit are placed in a row. The working steam pressure will be 250 lb. per square inch, which is from 25 lb. to 50 lb. greater than the usual steam pressure in generating stations. For the completed station there will be six chimney stacks, and three of these will be erected for the portion now under construction. These stacks are circular in section and constructed of steel lined with fire-brick. They are 17 ft. in inside diameter and extend 250 ft. above the boiler-room floor. The basement of the boiler house also contains the machinery for the oiling system for the station.

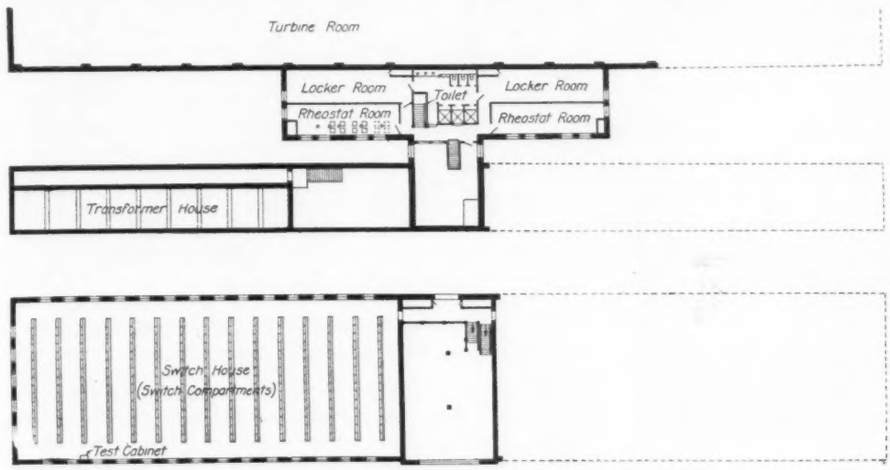


Fig. 6—Second Floor of Operating-Gallery Bay and Switch House.

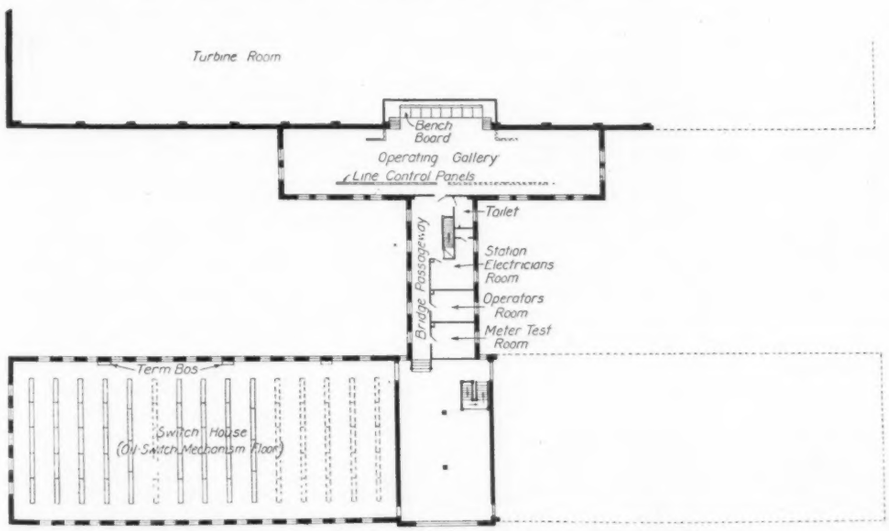


Fig. 7—Third Floor of Operating-Gallery Bay and Switch House.

TURBINE-ROOM EQUIPMENT.

The turbine-room, directly east of the boiler house, will contain when completed a row of six 20,000-kw turbo-generator units. Two of these will constitute the initial installation These units will be the largest electric generators ever built, and the first two will consist of 4500-volt, 25-cycle, three-phase, alternating-current generators vertically mounted on steam turbines provided with condensers in the base and below the turbine-room floor. Some of the future units will no doubt be built for a frequency of 60 cycles. Ventilating ducts leading to the tops of these units will be provided, as in the case of the units at the Quarry Street station.

Aside from the condensers, the other steam auxiliaries will be placed on the turbine-room floor. They will be arranged on the unit system, somewhat similar to the plan followed at Fisk Street. All of these auxiliaries will be steam-driven. In the completed station there will be four exciters, two, rated at 300 kw each, driven by steam turbines, and two, rated at 200 kw each, driven by electric motors. There will also be a storage battery for excitation and another storage battery for operating switches and for emergency lighting.

The turbine-room is 55 ft. high from the floor to the bottom of the roof girders. It is finished in white enameled brick and is spanned by a 110-ton overhead traveling crane. The generating units are 27 ft. high from the floor to the top of the governor, and are 15.5 ft. in largest diameter. Each one is provided with a 16-in. steam header. It is an interesting fact that these great 20,000-kw units are spaced on 44-ft. centers, whereas the 12,000-kw units at Fisk Street are spaced on 42-ft. centers. A notable increase of output per square foot of turbine-room area is thus secured by the larger units. The turbine-driven exciters are placed in an alcove under the boiler-room floor, while the motor-driven exciters are in an alcove under the operating gallery. The illumination of the turbine-room will be furnished by flaming-arc lamps placed on the ceiling girders. There will be no bracket lamps and thus no direct light in the operators' eyes. A railroad track extends the entire length of the turbine-room near the east wall.

INTAKE AND DISCHARGE TUNNELS.

Condensing water will be obtained from the North Branch of the Chicago River. A crib is being built at the river's edge at a point equidistant from the present station and the second station, and from it an intake tunnel will lead to the turbine-room of each station. The second station will be built north of the present station, and is planned to be a duplicate of it. In the case of the present station the intake tunnel will be about 1200 ft. long. It will be approximately rectangular in shape and about 90 sq. ft. in section. The discharge tunnel will be over the intake tunnel and follow the same route for the greater part of the length of the intake tunnel, departing from it, however, to discharge directly into the river. The path of these tunnels is shown on Fig. 8. Where one tunnel is thus superimposed above the other they are built together in the form of one reinforced-concrete structure.

OPERATING GALLERY.

As shown in Fig. 3, the operating gallery is in a bay on the east side of the turbine-room. This operating-gallery bay consists of three floors. A new feature is a separate rheostat-room (shown in Fig. 6), on the second floor of this bay, in which are placed all generator rheostats. The two storage batteries previously mentioned are in the basement of the operating-gallery bay. The operating gallery proper is on the third

floor of this bay and is connected with the switch house by a covered passageway leading over the transformer house, as shown in Figs. 4 and 7. The operating gallery proper projects into the turbine-room in such a manner that the switchboard operators have a full view of all generating units and

SWITCH HOUSE AND SWITCH GEAR.

East of the transformer house is a switch house forming a separate structure, and the most eastern of the group. The 9000-volt leads from the auto-transformers to the switch house are covered with double-braided varnished-cambric insulation,

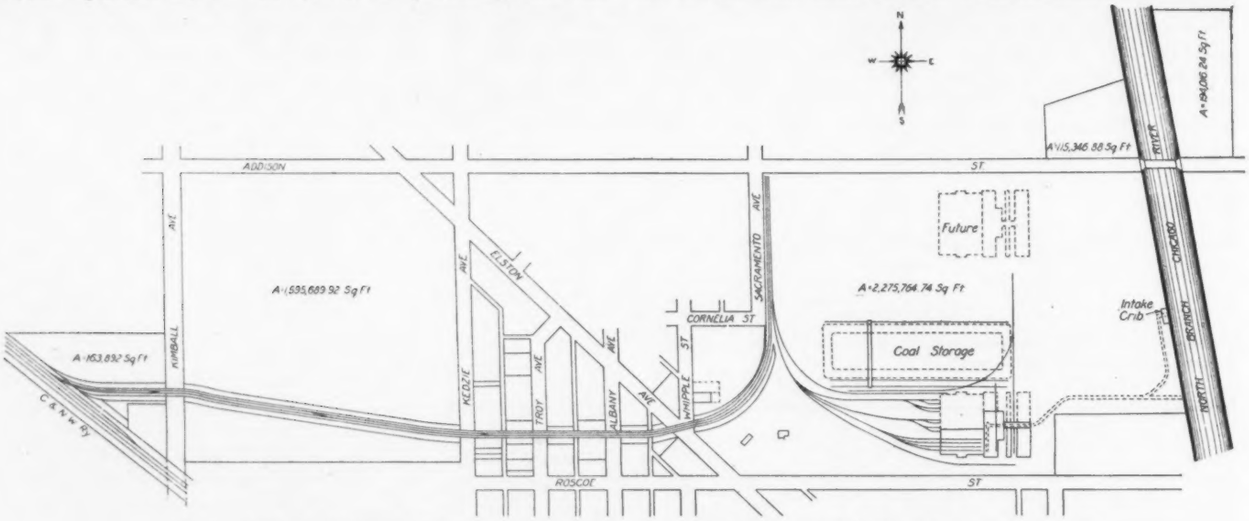


Fig. 8—Map of Northwest Station Property, Chicago, Showing Elevated Railway for Coal Delivery.

accessories on the turbine-room floor. The generators are controlled from benchboards located here, while the line-control switches and instruments are placed on vertical panels.

BUILDING FOR TRANSFORMERS

Lead-covered cable leads pass from the generators to the transformer house, which is in a separate one-story building directly east of the turbine-room, and like it, having its major axis north and south. In this transformer house there are three 3333-kva auto-transformers for each unit, raising the generator potential from 4500 volts to 9000 volts. These transformers are oil-insulated and water-cooled. Each stands in a separate fireproof compartment and is placed on a truck which can be moved out to an unloading platform and transferred directly to repair shops on a railroad track. The oil-pump room, the neutral oil-switch room and the neutral busbars are also placed in the transformer house. South of the structure is an oil-tank pit, with a reservoir serving to drain oil from the transformers in emergency.

and are supported in a special vault, in a manner similar to the high-tension buses. The switch house has three floors. On the first floor are the high-tension buses, the instrument transformers and the bells of the outgoing transmission lines, of which there are nine for each unit, with an arrangement to take care of twelve ultimately for each unit. On the first floor the line and generator buses run east and west, while the main and auxiliary buses run north and south. Fig. 9 is a plan of the buses and the line connections, showing this simple and convenient arrangement.

The second floor of the switch house is the oil-switch room. There are nineteen oil switches for each unit. Of these nine are line switches, eight group and tie switches and two generator

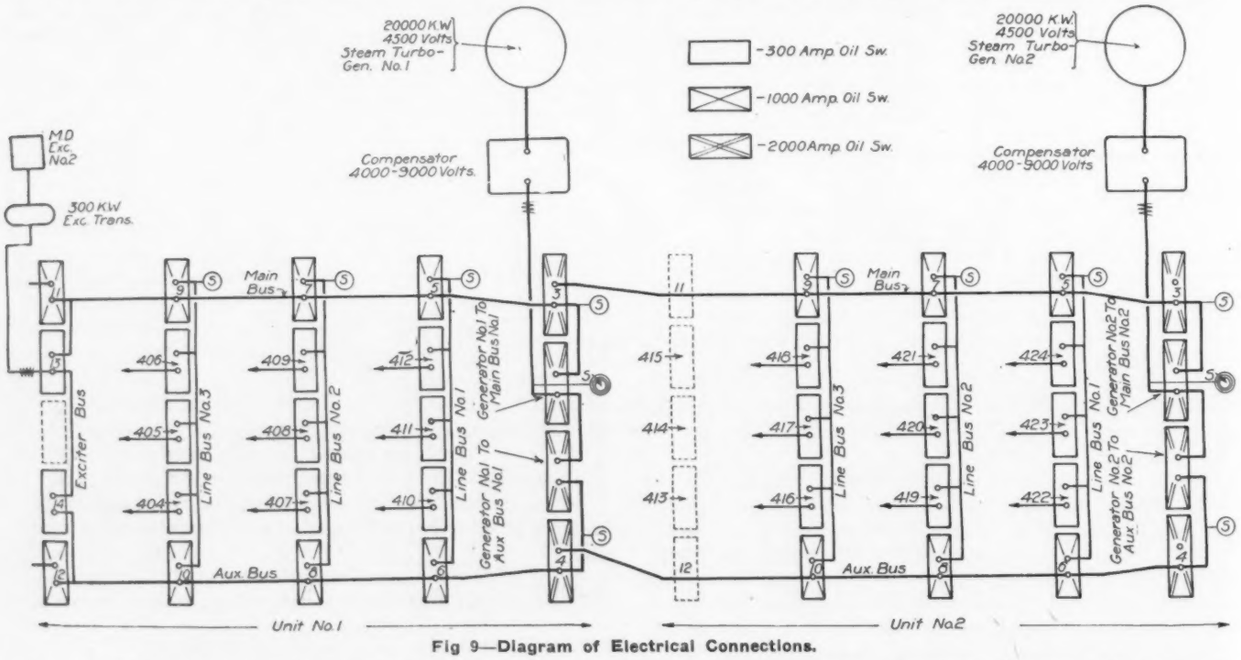


Fig 9—Diagram of Electrical Connections.

switches. Only the oil pots and disconnecting switches are on this second floor. A special feature is that the oil pots are arranged in single rows rather than in double lines. Thus there are provided four rows of oil pots for each unit, space being left for a fifth row. The single-row arrangement simpli-

fies materially the busbar connections. Each phase will have a lengthwise compartment of two oil pots arranged longitudinally rather than transversely. This arrangement also insures greater safety, because the longitudinal arrangement permits protection for each line of oil pots by a solid wall without sacrificing ease of inspection and cleaning.

The third floor of the switch house will contain all the operating mechanisms for the oil switches, entirely separate from the parts carrying high-tension currents. The operating mechanisms are raised only slightly from the floor, with the exception of the generator and tie switches, which will have part of the oil-switch compartments above the floor. Figs. 3, 6 and 7 show the general arrangement of the three floors of the switch house.

In the basement of the switch house there will be two cable vaults running north and south, one placed next to the east wall of the building and one next to the west wall. These are for the outgoing transmission lines and are connected by means of ducts in such a way that several distinct routes of cable runs to various parts of the city may be established. The main bus walls in the switch house are of concrete, while all barriers and switchboard compartments are made of "elecrete" slabs. Of course, the whole station is made as nearly fireproof as human ingenuity can devise.

STATION LIGHTING, HEATING AND MOTOR SERVICE.

All the lamps and motors on the premises will be supplied with energy from 60-cycle, 115-230-volt circuits. Two 750-kw, three-phase transformers in the switch house will supply this energy, at first receiving 12,000-volt, 60-cycle energy from the Quarry Street station and reducing the emf to 230 volts. Ultimately, however, 60-cycle energy will be generated at Northwest station. All motors used within the plant, including crane motors, will be of the induction type exclusively. The motor load will be about 900 hp connected rating, while about 2100 incandescent lamps and fifty arc lamps will be required.

Three distribution boards for local lighting will be placed about the premises—one in the switch house, one in the transformer house and one in the boiler-room. Direct-current incandescent lighting will be provided in the watch engineer's office, in the exciter switchboard rooms in the operating-gallery bay, and in the operating gallery itself. These circuits will be connected to a storage battery so that they cannot fail in any conceivable emergency.

For testing generators and connections and transmission lines a 500-kva, 20,000-40,000-60,000-volt transformer will be placed in the transformer house. The primary winding of this transformer will be actuated by 25-cycle, 300-volt energy supplied from a motor-generator set.

A passageway will connect the basement of the operating gallery of the turbine house with the basement of the transformer house and the basement under the central portion of the switch house. This passage will contain steam-heating mains and ventilating ducts. The operating gallery and the switch house will have an indirect-heating system, warm air being supplied from heating coils in the switch-house basement. Steam for these coils will come from the boiler house through the passage mentioned, and warm air will be forced into the different rooms by ducts. A ventilating system will also be provided.

CONCLUSION.

It is expected that the first of the generating units will be in operation by September next. During construction an extensive use of electrical energy is made in operating hoists, concrete mixers, etc. For this construction service, including also temporary lighting, a bank of three 50-kw transformers has been erected.

The list of architects, engineers and principal contractors engaged on this large and extremely interesting plant is as follows: Architects, Holabird & Roche; consulting engineers, Sargent & Lundy; electrical engineers, engineering department of Commonwealth Edison Company; general contractor, George A. Fuller Company; structural steel and elevated-railway bridges, George W. Jackson, Inc.; docks, tunnels and track construction, James O. Heyworth; boilers and furnaces, Babcock & Wilcox Company; generating units, exciters, oil switches and electrical equipment, General Electric Company; condensers, Henry R. Worthington; turbine-room crane, Morgan Engineering Company; coal conveyors, Mead-Morrison Manufacturing Company; coal-handling crane, Whiting Foundry Equipment Company.

MUNICIPAL WATER-POWER PLANT AT BLACK RIVER FALLS, WIS.

WITH the great leaps and bounds by which the use of electricity is advancing for uncounted purposes the design of any generating station, whatever its present size, must take into consideration extensions of equipment to serve the growing demands of the next few years. The accompanying illustrations show how the future has been provided for

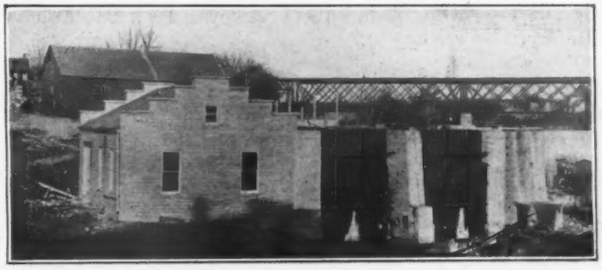


Fig. 1—Exterior of Power House, Showing Provision for Extra Water Wheel Unit.

in the construction of a small municipal water-power station in Wisconsin, the design having been carefully worked out so that an increase in generating capacity of 300 per cent can be made with a minimum of expense when the changes are to be effected.

The plant is that of the City of Black River Falls, in south central Wisconsin, and utilizes an 18-ft. head in the Black River which passes through the town and gives it its name. The local plant enjoys the advantage of being about twelve miles below the extensive water-power developments of the La Cross Water Power Company, at Hatfield, and gains the benefit of the great season-storage reservoirs impounded behind the dams of this company on the headwaters of the Black River. A highly uniform stream flow is thus assured to the municipal plant throughout the year.

The first installation made in the Black River Falls plant,

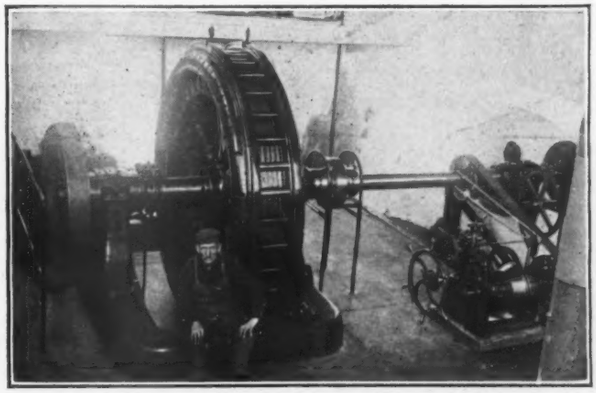


Fig. 2—Interior of Municipal Water Power Plant at Black River Falls, Wis.

which was only recently completed, consists of a single 400-hp pair of Leffel waterwheels direct-connected to a 400-kw, 2300-volt, 60-cycle, three-phase Fort Wayne alternator. The present waterwheel unit is installed in the first bay of the waterwheel chambers, seen next to the power house in the illustration, and

though rated at only 400 hp is large enough to carry the present station demand on the 400-kw generator. To operate this machine at full load, of course, about 700 hp will be required, and when the load conditions reach this point the second 400-hp pair of waterwheels will be mounted on the same shaft, which extends through the middle concrete wall and into the second wheel pit, shown at the right. Later, it is expected that the use of electricity in the town will exceed even the full-load rating of the 400-kw machine, and then a second similar unit will be installed in the partially completed wheelpit toward the foreground of the picture, the shaft openings for the future wheels being shown in the illustration. The bulkhead wall of the present wheel pits is formed of heavy wooden planking supported by steel beams, and when the second unit is installed it will be necessary only to move these bulkheads a few feet down stream to the new sockets provided for them. The planking was used for making this closure in preference to a permanent concrete wall, which would have been expensive to tear out and rebuild in the downstream position. However, the back penstock wall shown will be moved down and made of reinforced concrete.

The governor of the present waterwheel unit is of the Woodward mechanical type and the exciter generator is belt-driven from the main shaft. The foundations and walls of the power-house structure are all of concrete, being made water-tight up to the sill of the entrance door as a protection against backwater from the tail-race in case of flood. Mr. Theodore Mason is chief electrician of the Black River Falls municipal lighting plant, which was designed and installed under the direction of Messrs. A. L. Bogart and J. W. Schuman, of the Power Engineering Company, consulting and contracting engineers, Minneapolis, Minn.

COMBINATION WATER-WORKS AND ELECTRIC PLANT AT WINNETKA, ILL.

WINNETKA, Ill., a residential suburb containing 3600 mostly well-to-do people, on the shore of Lake Michigan, 17 miles north of Chicago, has finished reconstructing its municipal water-works and electric-lighting plant, including the addition of new machinery. The plant is on the lake shore at the foot of a 70-ft. clay bluff, on the top of which is the village. In exterior finish the station, together with the water tower on the plateau above, is a really ornamental addition to its attractive neighborhood. The building, 125 ft. x 54 ft., exclusive of its hillside coal bunkers, is of red pressed brick, with green wooden trimmings and a tile roof. Since the plant was started on a small scale eleven years ago all additional buildings and equipment, including the repayment of the first investment and the setting aside of a $7,000 fund, have been paid out of the actual plant earnings. The present plant, including distribution, cost about $80,000.

Fig. 2—Exterior View of Station.

The hillside arrangement of the station has made it possible to adopt several ingenious expedients for conveying coal down to the plant. Wagons loaded with coal are backed up to and dumped into the concrete coal hopper at the top of the bluff. From this hopper lead two 24-in. concrete tubular chutes to the bins below. By means of a gate in the hopper the coal can be sent down either chute as desired. At the lower end of each chute is a similar steel gate, which can be thrown to deliver coal into either of the pair of bunkers to which the chute delivers. In this way by proper setting of the gates the coal wagon, 60 ft. above, dumps directly into any one of the four bins desired. The four bunkers will hold 600 tons of coal. The entire construction is of reinforced concrete, and the weight of the mass is sustained by a 6-ft. x 3-ft. x 54-ft. concrete truss bedded on the clay bottom.

From the sloping bottom of the bins four valves open into the boiler-room, and can be used to fill a 600-lb. trolley bucket running on an overhead track past the bunker valves and the three boiler units. The two 200-hp Heine boilers are equipped with Illinois chain-grate stokers, and the third, 80-hp, boiler, which is held in reserve, is fitted with an American mechanically operated underfeed stoker. The flue gases from the furnaces are led to a 200-ft. self-supporting steel stack, founda-

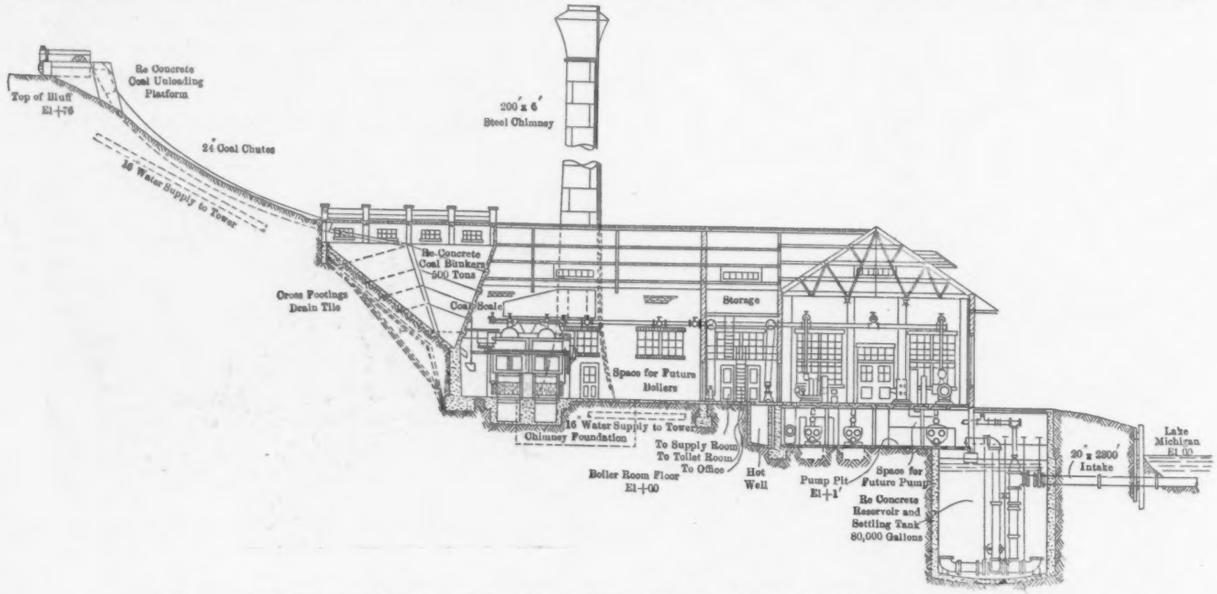


Fig. 1—Longitudinal Section of Combined Water-Works and Electric Plant at Winnetka, Ill.

tioned outside the building. This stack is 16 ft. in diameter at its base and tapers upward to a diameter of 6 ft. at the top. All coal fed to the furnaces is weighed in the hopper bucket on a section of the overhead track, which is supported by a scale beam.

Between the boiler-room and the engine-room is an inter-

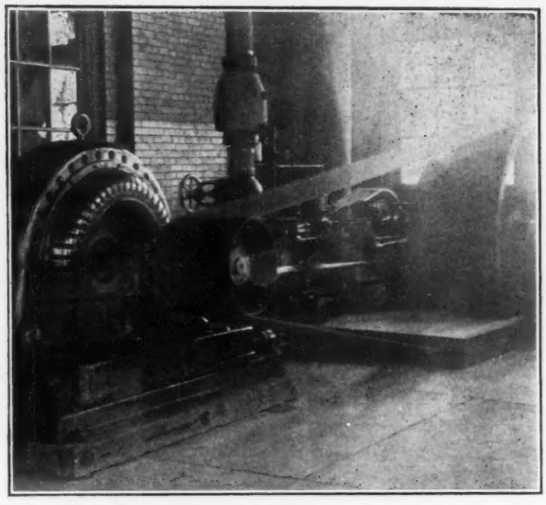


Fig. 3—Engine-Driven Alternator in Winnetka Plant.

mediate 15-ft. x 54-ft. space fitted up as a machine shop with lathes, drill press, shaper, etc. A skilled machinist is employed as operating engineer, and practically all the plant repairs are made in the station. The engineer consequently spends much of his time in the machine shop, and as this room is fitted with large glass windows opening into both the boiler and engine-rooms, he is in immediate supervision of the entire plant at all times, although engaged usefully in repair work. One end of the machine shop is inclosed for an oil-storage-room, and adjoining it is a modern toilet and bathroom. Over these is the plant office, and on the floor above is a general supplies storage space. The location of the machine shop between the engine and boiler-rooms also prevents smoke and dirt reaching the machines, which was a partial reason for this design.

The engine-room is 40 ft. x 54 ft. in floor dimensions with clear head room of 22 ft. to the underside of the 13-ft. roof trusses. It contains one 300-hp Erie City tandem-compound, four-valve engine belted to drive a Western Electric 2300-volt, 60-cycle, two-phase alternator at 900 r.p.m. The exciter is belt-driven. The other and smaller generating unit comprises a 200-hp Erie City simple engine driving a 115-kw Bullock alternator with exciter on the generator shaft. Both of these machines, including the steam pumps in the basement, are operated condensing, exhausting into Deane jet-type condensers.

Supplies for the plant, oil, machinery, etc., can be lowered down the bluff by a small car which runs on a track out of the plant and thence onto the steel sidepieces of the iron stairway up the bluff. One of the hollow handrails is continuous throughout the length of the stair, and through this will be run a cable from a winch in the power house below. At the top of the railing will be a folding, ornamental pulley beam which can be placed across the passage, serving as a block by which the car can be hoisted up the incline by the winch.

The steam pumps for the water-works are located in the open basement at a level 8 ft. below the generator-room floor and about 16 in. above the mean height of Lake Michigan. There are two 635-gal. pumps and one larger pump delivering 2,000,000 gal. per twenty-four hours. The steam cylinders of these pumps operate expansively, exhausting into the condenser line, on which a vacuum of 26 in. is carried. The intake pipe extends 8000 ft. under Lake Michigan, tapping the pure water off shore. The land end of this line opens into a circular concrete well, 23 ft. in diameter and 26 ft. deep. This well, with walls 18 in. thick, was constructed by building first a ring section with sharpened bottom, then adding successive concrete rings as the first section sank into the sand. In this way a solid, water-tight well, 26 ft. deep, was formed. The 20-in. suction pipe from the intake well is provided with connections for installing in all four pumps with 12-in. suction lines. The delivering header from the pumps ascends 79 ft. from the pump-room level to the base of the 120-ft. water tower on the bluff level. The 50,000-gal. tank in this tower provides water pressure sufficient to throw a fire stream over any house in Winnetka. The extreme lift of the pumps from the lake level to the 30-ft. tower tank is 200 ft.

Lighting service is distributed single-phase from the plant switchboard at 2200 volts, 60 cycles, being stepped down by transformers at distribution points in the village. There are now 760 electric customers, some of whom use day motor service, taking advantage of the twenty-four-hour operation inaugurated in the plant eighteen months ago. Most of the consumers are householders whose business is in Chicago and the electric bills in these comfortable homes range above the average. The average income per customer is about $48 a year at the straight rate charged, 12.5 cents per kw-hour, regardless of use. Energy for motors is furnished at 10 cents per kw-hour. The minimum bill in any case is 50 cents a month. The principal business of the plant is, of course, lighting, the daily peak for this service reaching more than 200 kw. In addition to the commercial lighting, 248 series incandescent street lamps are furnished at an annual rate of $25 a lamp.

The Winnetka plant was originally started by the village government as a water-works, the cost of apparatus being defrayed by special assessment. In 1900 the general fund had accumulated enough earnings to withstand a loan of $8,000 to the electric fund for starting an electric plant. Time warrants were also issued for $10,000 and later for $5,000. Two years ago reconstruction of the combined plant was started, and these

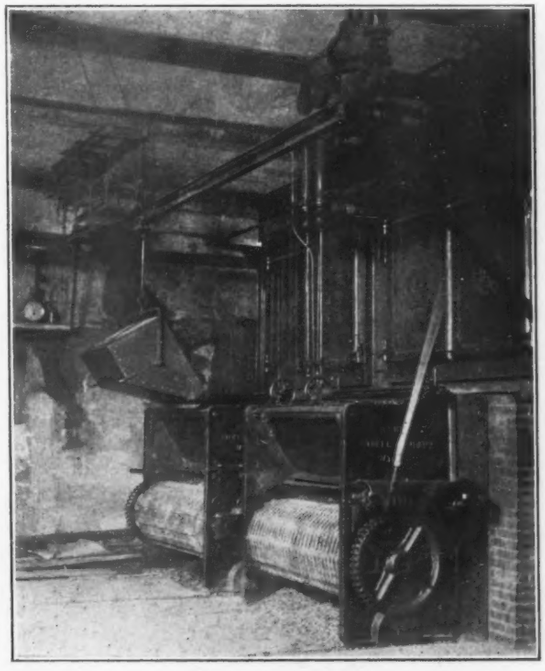


Fig. 4—Coal-Bunker Valves, Trolley Bucket and Mechanically Stoked Boilers.

changes and additions have just been completed at a cost of $35,000. All of this amount, besides the repayment of the original loan and the time warrants, has been paid out of the electric-plant earnings, leaving to the credit of the electric fund a balance of $7,000, besides $25,000 in street-lighting charges during the eleven years. The successful results

attained in the case of the Winnetka plant have come from an application of business principles to the station affairs and the entire removal of all plant matters from local politics. The residential character of the suburb fortunately places on a high plane matters of local government, and the relatively large incomes from the individual consumers have made possible results in Winnetka that might not be equaled under other conditions. During the eleven years of successful operation of the combined water and electric properties they have been in charge of Mr. F. E. Herdman, manager and engineer, who also designed the operating features of the new station.

PRODUCER-GAS ENGINE ELECTRIC PLANT AT PORTLAND, ILL.

An attractive municipal electric-light plant has been put into operation recently in Portland, Ill. It is small in size, but modern in design and housed in its own building of rather neat appearance. Two 35-hp gas engines, made by the International Harvester Company, are belted to two Fort Wayne 25-kw, revolving-field, 2300-volt, three-phase alternators connected in single phase. Ultimately the waterworks will be operated in connection, the pumps being driven by gas engines.

Gas is obtained from two 35-hp producers made by the Smith Gas Power Company. These producers are of interest on account of the simplicity and effectiveness of the scrubbing apparatus and also owing to the small floor space occupied. The ordinary tower scrubbers are dispensed with and a special form of baffle scrubber of small size, but apparently very efficient, is used instead. This not only reduces the floor space, but adds materially to the safety of the plant, since the amount of gas contained in the scrubber and piping is so small that even if mixed with air and ignited the resulting explosion could do little damage. The producers are arranged to operate continuously twenty-four hours a day and are provided with a large magazine space, making it possible to run for ten to twelve hours on one charging. The attention required consists in cleaning and charging daily on ten-hour operation, or in cleaning and charging every six hours on twenty-four-hour service. The two producers are connected in such a manner that either one may operate either engine. The "mustard-seed" size of anthracite coal is burned in the producers.

For the purpose of placing the two alternators in parallel most conveniently use is made of an air-core synchronizing reactance coil as described on page 991 of our issue for April 20. When the two machines are to be joined together the reactance

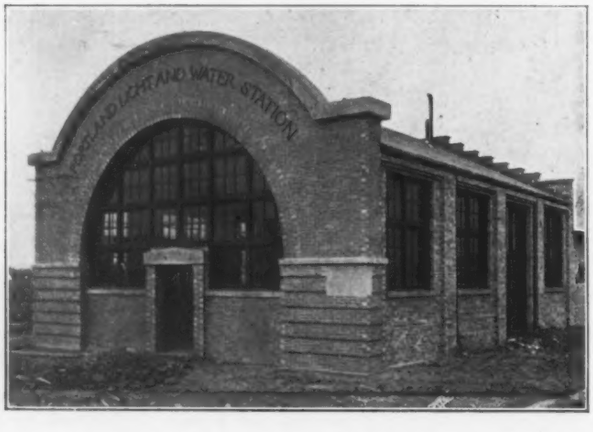


Fig. 1—Exterior View of Portland (Ill.) Municipal Plant.

is placed in circuit between them without any regard to the relative time-phase positions of the alternators. The reactance limits the current to a permissible value and gives it such a time-phase position as to tend to accelerate the slow machine and retard the fast one, thereby bringing them into exact synchronism and correct time-phase position. The reactance is then short-circuited and the engine governors are adjusted to divide the load between the machines as desired.

The generators are three-phase machines, but they are operated as single-phase alternators. The plant supplies electrical energy for 104 100-watt series tungsten lamps used for the street lighting of Portland. These lamps are operated on 4 amp. The regulating transformer is rated at 16 kw, which will allow a 33 per cent increase in the present street-lighting installation. Commercial lighting is also supplied to the merchants in the town, the emf being transformed down to 110 volts for this purpose. A two-panel switchboard is part of the station equipment. There is no motor load at the present time.

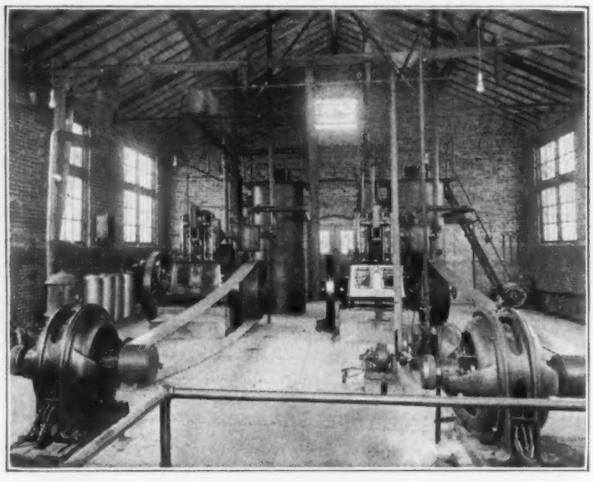


Fig. 2—Interior of Portland (Ill.) Municipal Plant.

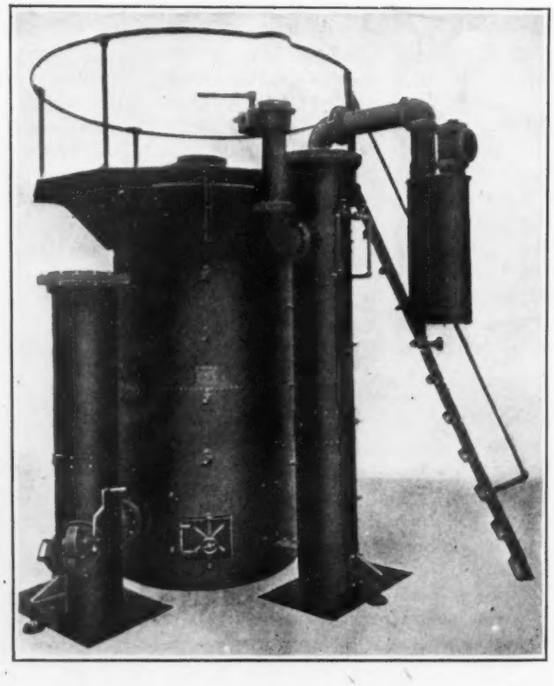


Fig. 3—Gas Producer Used in Portland (Ill.) Municipal Plant.

Three 100-watt lamps are placed at each street intersection and there is one lamp between corners. Mr. B. E. Avey, of the engineering department of the International Harvester Company of America, designed this attractive little plant.

DISCUSSION ON COAL AT NEBRASKA CONVENTION.

Mr. R. E. Burger, general manager of the Fremont Gas & Electric Light Company, gave at the Nebraska Electrical Association convention in April a paper on "Coals Available for Nebraska Power Plants" which contained information of value to central stations in all parts of the country. Of several coals having a similar composition the one that has the least moisture and the least ash will generate the most steam when burned under a boiler. In the coals available in Nebraska the proportion of ash may range from 4 per cent to 30 per cent. Coals containing small percentages of ash are the most valuable, not only because of their correspondingly high heating value, but because they offer less resistance to the free and uniform distribution of air through the bed of coal in the furnace. The labor and cost of managing fires and handling ashes are also correspondingly less, and are items to be considered in the choice of coal. Of two coals of different character the one that contains the highest proportion of fixed carbon is most easily burned, so as to give the maximum efficiency. However, the coal containing the higher volatile matter if properly burned in a suitably designed furnace may be made equally efficient. The size of the coal influences the capacity of any given equipment, owing to its effect on the draft. With a poor draft fine coal cannot be burned in sufficient quantities to maintain the rated capacity. If thin fires are resorted to the efficiency is usually lowered as a result of an excessive supply of air through holes in the fire. Dust or fine coal may either check the flow of air or be taken up by the draft. In general it may be said the coal obtainable at the lowest price is the most economical, provided the furnace equipment is suitable. If the furnace is not so designed as to use the cheaper size it should be changed. If in the purchasing of coal it is found that all other conditions are equal coals of similar composition are of value in proportion to the number of heat units contained per pound. Nebraska obtains its coal mainly from the surrounding States of Iowa, Missouri, Kansas, South Dakota, Wyoming and Colorado. The author gave the analysis of a number of different kinds of coal from these States, and concluded that the coal produced from the Kansas field shows a marked superiority over any of the other coal. He presented results of some tests carried on in the steam plant of a brewery at Fremont, Neb., by Mr. W. B. Stark. One test was made of Weir City (Kan.) slack coal under a Kenny water-tube boiler, and another of Weir City nut coal under the same type of boiler. With the slack coal 7.52 lb. of water was evaporated from and at 212 deg. per pound of coal, and in a second test, 7.61 lb. The gain by the use of nut coal was 1.2 per cent. He also gave the results of some United States government Bureau of Mines tests on washed coal and gave it as his opinion that the increase in price on washed coal is very much out of proportion with the increase in value.

DISCUSSION.

Mr. L. J. Schwingel, of Holdrege, Neb., said that tests in his plant showed that they were able to save about 4 mills per kw-hour by using Weir City (Kan.) slack as compared with Iowa, Wyoming or Missouri coals. Slack coal costs about $4 per ton. It is burned wet.

Mr. F. H. Brooks, superintendent of the Lincoln Traction Company, said that coal results depend almost altogether on the furnace design. Certain tests made with hand-firing showed that the best efficiency was obtained with nut coal. By changing to finer grates and using forced draft the conditions were reversed and nut coal was made the most expensive. The use of Jones underfeed stokers improved the efficiency and made most economical the lowest grades of coal.

The question then came up of storing large quantities of coal under water. Mr. Burger told of a 10,000-hp plant at Joplin, Mo., where a coal storage of 10,000 tons capacity had been built, consisting of a tank 100 ft. x 80 ft. x 20 ft. deep made of concrete. A traveling crane and grab bucket over the tank provides for the removal of the coal.

Mr. H. A. Holdrege, general manager of the Omaha Electric Light & Power Company, said that his company was building a concrete tank to store coal 100 ft. x 100 ft. x 20 ft. deep, the cost to be about $39,000 for the tank and $10,000 for the crane. The crane, however, would be in a position to serve an additional tank should one be built. The tank would be much cheaper but for the fact that it was built on quicksand and much piling foundation had to be put in. He brought up the point, in regard to the burning of low-heat-unit coal, that it is impossible to obtain as high boiler capacity as with coal containing more heat units per pound. By the use of low-grade fuel the capacity of the boilers and the temperature of the furnaces are reduced and consequently the efficiency is reduced.

Mr. F. H. Brooks said that with proper furnace design and a grate area large enough cheap fuels can be burned with better economy than higher grade fuels. If the furnace is not large enough to get the capacity out of the boiler with low-grade fuel it should be enlarged.

Mr. Charles Smalley, of the Lincoln Gas & Electric Light Company, discouraged the use of mine-run coal because of the holes it is likely to leave on the grates as it burns down. For this reason slack is better because of the even bed of fuel it produces. In his experience at Lincoln he had found no nut coal equal to Weir City slack.

COAL PER KW-HOUR IN SEVERAL PLANTS.

The discussion then took the form of an experience meeting, in which representatives of a number of plants gave the average pounds of coal per kw-hour consumed under actual running conditions.

Mr. L. J. Schwingel, of Holdrege, Neb., operating a small plant with high-speed engines and 3 lb. to 5 lb. back pressure, in connection with an exhaust steam absorption ice machine, reported 11 lb. per kw-hour.

Mr. Bell, of David City, operating a simple Corliss engine half the night, reported 7 lb. per kw-hour.

Mr. H. A. Holdrege, general manager of the Omaha Electric Light & Power Company, operating a steam turbine plant condensing, reported 3.1 lb. per kw-hour.

Mr. F. H. Brooks, superintendent of the Lincoln Traction Company, operating engines condensing part of the time and part of the time against back pressure on a steam-heating system, reported 5 lb. per kw-hour condensing and 9 lb. per kw-hour under extreme back-presssure conditions.

Mr. T. O. Kennedy, of the Lincoln Gas & Electric Light Company, operating a plant with steam turbines and compound condensing engines, using Kansas slack, reported 7 lb. per kw-hour.

Mr. Bell, of David City, reported that, inasmuch as his plant had a boiler capacity considerably more than needed for light loads, the plan had been adopted of building an 18-in. firebrick partition across the middle of the grate and banking the fires on one side of this partition during light loads.

OIL AS A BOILER FUEL.

Mr. T. O. Kennedy, superintendent of the Lincoln Gas & Electric Light Company, presented a paper on "Oil as a Boiler Fuel" at the convention of the Nebraska Electrical Association at Lincoln in April. He took up the questions of furnace design and comparative heat value of oil and coal.

He first laid down the fundamental principle that to burn any fuel efficiently the furnace must be designed especially for that fuel. Although the physical properties of oils used as fuel in the United States differ widely, their heating values may usually be taken as a constant quantity. This constant is approximately 19,000 heat units per pound. The fuel most available in Nebraska is known as a reduced oil, being crude petroleum from which the lighter and more volatile oils have been distilled. This has more heat units per gallon than the crude oil because of its higher specific gravity.

Storage tanks for oil should be isolated from the boiler-room as a safety precaution. A plant equipped for burning oil ex-

clusively should have storage capacity for at least thirty days' requirement. For the same heating value oil occupies half the space and weighs 35 per cent as much as coal. The arrangement now generally accepted as being the best practice is to draw oil from the storage tank by a constant-speed pump and force it through the burners.

The burner principally used in this country is of the inside mixer type in which the oil enters under pressure and is vaporized by the action of air or steam jets. Most plants find it more economical to use steam jets because of the expense of maintaining a supply of compressed air. A good oil burner must thoroughly atomize the oil and be simple in design so as not to be easily clogged. After the correct proportion of oil and steam is adjusted the burner should be arranged to increase or decrease the flame by the opening or closing of one valve governing both the oil and steam.

Mr. Kennedy uses in Lincoln an oil pressure of 30 lb. and a steam pressure of 35 lb. Steam is partly superheated by running the steam pipe through the boiler setting near the back. It is also well to have the oil heated almost to volatilization when it enters the burner. However, with either the steam or oil too hot, carbon will be deposited and clog up the burner. The most important detail of an efficient oil-burning installation is the design of the furnace into which the atomized fuel is blown. This furnace must conform to the requirements of perfect combustion, which briefly stated are that every particle of fuel shall come in contact with no more or no less air than it theoretically needs for its complete combustion and that it shall come in contact with this air before it reaches a part of the furnace which is below the temperature of ignition.

There are then three ways in which the furnace may be wasteful. First, it may supply more air than is needed to burn the fuel. Second, it may supply less air than is needed, allowing some fuel to go up the stack unconsumed. Third, the temperature in parts of the furnace where the air and fuel come together may be below the temperature of ignition, which means that the fuel will not be consumed. The last two conditions are indicated by a smoky stack. The first condition is indicated by a clear stack. The air supply and distribution should be such that the stack is continually just on the point of smoking but does not smoke. It is necessary either to admit more air at the furnace than is needed or to admit small quantities at different points in the furnace for the combustion of any unconsumed fuel. With the latter method it is possible to cut down the excess air to a very small quantity.

In order to insure plenty of time for the air and fuel to mix before reaching the cooler portions of the furnace, it is necessary to have a very large volume of flame and a combustion chamber where the flame can be confined until the chemical action of combustion is complete. Failure to observe this point means that unconsumed fuel will strike the boiler surface and in addition to causing waste of fuel will also result in blistered tubes. This is the foundation for the popular belief that fuel oil increases the expense of boiler repairs. With a properly designed furnace the repair account is decreased rather than increased by changing from coal to oil as fuel. The available air supply must be large enough to take care of the largest overloads and the combustion chamber must also be large enough to accommodate the largest flame used. It is necessary in some settings to lower the ash-pit level and to install the burners almost at the bottom of the regular ash-pit doors.

Usually, however, the following construction will suffice for a tubular boiler. A burner is placed in a hole drilled through each fire door. These burners are set so as to direct the oil flame against a firebrick incline built from the bridge wall toward the front. Air is supplied to each burner through openings in the ash-pit door. As the flame passes over the bridge wall more air is admitted through an opening communicating from the rear of the setting. Behind the bridge wall all along the bottom of the chamber are a large number of very small openings through which additional air may be admitted. All these different sets of openings are equipped with dampers so that the distribution as well as the amount of air supplied is under the control of the fireman. Peepholes are provided in order that the fireman may judge the condition of the furnace, changing the dampers until the entire combustion chamber reaches a uniform temperature and is very bright red in color.

In the case of a water-tube boiler it is not so easy to provide a long combustion chamber. Extra precautions must be taken to insure perfect combustion before the flame reaches the tubes. This is accomplished by means of a firebrick arch built just in front of the bridge wall, which causes the flame to return on itself before it has a chance to be chilled by the water surface of the boiler. In order to secure as large a combustion chamber as possible, the burners are placed one in each ash-pit door, the fire doors being closed slightly. Air is admitted through six passageways under a false firebrick bottom laid in the fire box. Small openings are left in this false bottom so that the air can come up at points all over the furnace. One passageway leads directly to an opening at the top of the firebrick arch and considerable air is admitted at the point where the flame is deflected back toward the front of the boiler. In order to insure the advantages of a longer combustion chamber some installations include a "Dutch oven" built out in front of the boilers, which allows the burners to be located several feet in front of the boiler front. For permanent installations there is no doubt that this is a good arrangement.

Given a properly designed furnace it still requires great care in operation to insure good efficiency. This is probably more true than in the case of a coal furnace, the reason being that, because of the nature of the fire bed, coal tends to limit the passage of air through the furnace. With oil there is nothing to obstruct the draft except the dampers, which must be adjusted by the fireman. It is not safe to be satisfied with a clear stack for reasons before mentioned. With a perfect air supply the flue-gas analysis would show 15 per cent of CO_2. With 10 per cent CO_2 the theoretical furnace efficiency is 70 per cent. It is not at all impossible to operate regularly a fuel-oil furnace at an actual efficiency of 80 per cent to 85 per cent. The coal furnace that shows an efficiency of 70 per cent is much above the average.

Comparing fuel oil with 19,000 thermal units per pound and Kansas coal with 11,000 heat units per pound, one short ton of coal equals 143 gal. of oil. As a matter of fact one ton of coal is equal to only about 130 gal. of oil, because of an increase of about 10 per cent in furnace efficiency when oil is substituted for coal. This increased efficiency is really nearer 15 per cent, but 4 per cent of the steam generated is required to operate the burners and oil pump. In most plants in Nebraska Mr. Kennedy considered it safe to say that the boiler-room labor for handling and firing coal amounted to 50 cents per ton. In any boiler-room requiring more than one fireman per shift for coal burning the labor cost could be reduced at least 50 per cent by the use of oil fuel. Other advantages of oil are increase of boiler capacity, 30 per cent to 40 per cent, because of higher furnace temperature, lessened liability of labor trouble due to fewer men employed, possibility of larger storage due to smaller bulk and weight of fuel. With the coal situation as it is in Nebraska, the ideal arrangement would be to have half the boiler capacity equipped for oil burning and arranged so that were cheap coal available the oil burners could be disconnected and grates put in. With a week's supply of non-depreciating fuel always on hand the central-station man would enjoy many a good night's sleep that he would not get were he dependent on coal shipments to keep his plant running.

DISCUSSION.

Mr. F. H. Brooks, superintendent of the Lincoln Traction Company, said that his company had installed oil burners partly to be in a measure independent of troubles in coal supply. With one kind of fuel the company is too much dependent on shippers and dealers. Under special tests in his plant, 13 lb. of water had been evaporated per pound of oil. With coal 7.3 lb. of water had been evaporated per pound of coal. He cautioned prospective users that unatomized oil striking boiler tubes would blister or burn them.

HOT-WATER RECEIVERS.

By Charles T. Baird.

WHILE hot-water receivers are frequently used to catch the hot water resulting from heating mills, shops and factories in the winter, they are also employed in connection with dry kilns in both winter and summer. When placed on a cast-iron base plate which also carries a good duplex pump, the combination is the best-known device for returning this hot water to the boilers without releasing it from presssure. They can also be used to drain the receivers of compound and triple-expansion engines to good advantage. As these receivers are not all alike, a discussion of some prominent points in their design cannot fail to benefit both owners and users.

Fig. 1 shows a very compact form of the device, as the pump is located directly under the receiver, thus occupying no more floor space than the receiver alone requires. This is a decided advantage where it is necessary to economize space, but the water valve cannot be removed conveniently nor their seats cleaned and repaired to the best advantage because the water cap is so near the receiver. There will always be a good head of water above the valves so long as there is any left in the receiver, thus making it possible to run the pump at a high rate without causing it to pound on account of partially filled water cylinders at every double stroke, because this head of water secures a full supply.

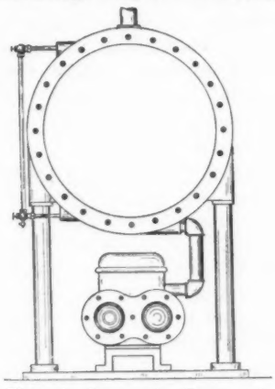


Fig. 1—Compact Form of Hot-Water Receiver.

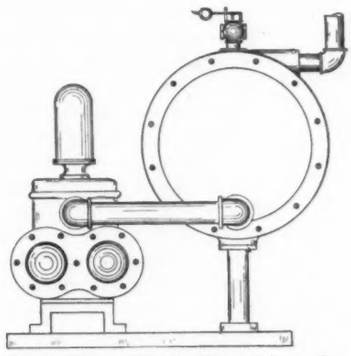


Fig. 2—Preventing Sediment from Going Into the Pump.

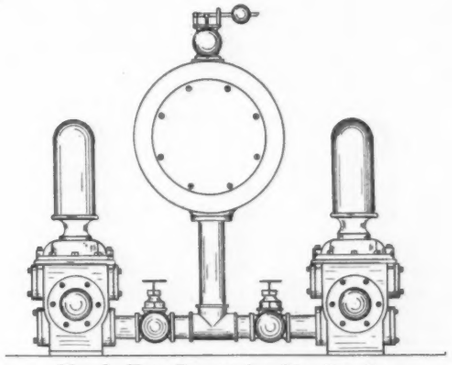


Fig. 3—Two Pumps for One Receiver.

All water will drain to the pump when it is desired to empty the receiver, but sediment which so frequently collects in these receivers when used in connection with heating systems will also gravitate to the water cylinders and may cause trouble there. One advantage of fibrous-packed pistons in this connection is that grit and sediment are less liable to cut the cylinders than when metal pistons with rings of the same material are used, as this foreign matter works in between the hard surfaces and causes trouble. On the other hand, fibrous rings at least make it possible for some of this matter to become embedded in the comparatively soft material, and it is thus rendered less harmful.

A glass gage is provided which shows the water level in the tank, provided the lower connection is not filled with mud. It is possible to keep this connection clear, but when located so low it requires frequent attention. As such a receiver is generally placed at the bottom of a pit, and owing to the lack of means for keeping it dry this pit contains water from 1 in. to 12 in. deep, no effort is made to keep the glass gage in good order, partly because it is seldom seen and partly owing to the fact that it is an unpleasant job. If the lower connection on all of these receivers was placed higher on the device it would be an improvement because sediment would not drift into it. As it is only needed to show when the water level is high, indicating that the pump is not doing satisfactory work, raising it would do no harm.

Fig. 2 is a good design because water is taken out through the head several inches above the bottom of the cylinder, and, therefore, sediment will not pass to the pump until a considerable amount has collected. The inlet appears to be nearly over the outlet, but a side view would show that it is located at the other end, thus preventing the incoming water from keeping the sediment agitated, as it must flow slowly along from one to the other.

When repairs are necessary or the plant is shut down for other reasons the water cap on this pump can easily be removed, uncovering all of the valves, and as there is nothing to prevent access to them there is no excuse for neglecting to keep them in good order. This point is more important than appears when the matter is first presented, for the following reasons: Pumps installed for this service must be ready for use at all times during cool weather, for, as a general rule, there is but one pump in a plant that can be used for this purpose. The exception, or the plant with duplicate pumping machinery of this kind, is rarely found. In some of these plants there are three machines for feeding the boilers, hence one of them at least is always in good order, but this forethought is not extended to the pump and receiver needed for removing the returning hot water and sending it into the boilers.

The only remedy that the operating engineer can apply to this defective condition is to give his one outfit special care, and, of course, this should be done whether the parts are easily accesssible or not. In some plants it is customary to allow all such matters to wait until failure of the pump to work well or perhaps its refusal to deliver water at all demands immediate attention. Especially is this true of jobs that are disagreeable and call for more work than would be required under better conditions.

Fig. 3 illustrates the exception mentioned, as it has two separate pumps taking hot water from one receiver. During cold weather when steam condenses rapidly and the resulting hot water must be pumped accordingly, both pumps are used, but when only a comparatively small quantity is coming into the receiver one of them may be shut down. Under this condition it is not necessary to shut the suction valve shown, but if the pump valves are to be taken out, or the pistons or the rods require packing this valve will be very convenient, for by shutting it hot water cannot rush down from the receiver and flood the pump. Both of these pumps are fitted with one steam and one water cylinder, hence are properly known as single pumps, although both are double-acting. As duplex pumps are used more than others in this service on account of their reliability in action even when the parts are badly worn, it seems odd to find the single type used, but, owing to the duplicate feature, one may be operated while the other is repaired, thus insuring continuous service.

In some plants the combined pump and receiver is taken apart as soon as cold weather gives place to the opening of spring, cleaned, inspected and repaired if necessary, then put together again ready for use, although it may not be wanted for several months. However, undue haste ought to be avoided, for another cold day may come before summer appears, when those employed to operate machinery, exclusive of the engine-room force, will call for heat and feel badly disappointed if they

cannot have it. This makes it necessary to start the pump and consequently have the work of "laying it up" to do over again or else admit that a part of the machinery is not ready for use when all of it ought to be available.

In contrast to this there are plants where no attention is paid to these details, as the hot-water receiver and pump is run as long as required, then the throttle valve is closed and nothing more is done until it is wanted again the next fall or winter. This is wrong, because sediment has probably collected in the receiver and the pump needs new packing. Even if the machine worked well the last day it was used it ought to be thoroughly overhauled before the approach of winter warns the engineer that it will soon be wanted again.

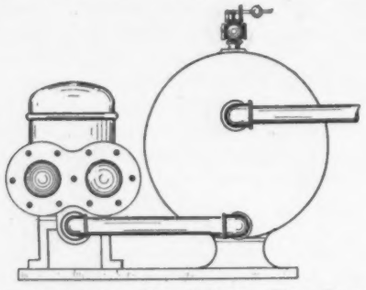


Fig. 4—Receiver Placed Lower Than Pump.

Fig. 4 illustrates a receiver the bottom of which is set lower than the pump cylinders, but the water level is above them because the receiver is large in proportion to the pump. Hot water is discharged through the upper part of this head and taken out through the lower part of the same head. This apparently is better than taking it through the bottom, but the arrangement is defective because the incoming water containing more or less sediment drops directly in front of the outlet; hence there is no chance for it to settle, as this action keeps it agitated as long as the system is in operation. There is a manhole in the opposite head which enables a man to go inside and clean it thoroughly. This large receiver is made of boiler iron, hence hot water standing in it causes the plates to become pitted. To overcome this objectionable feature they are scraped and painted with graphite.

Fig. 5 shows a smaller receiver located higher above the pump, thus giving head enough to overcome the tension of springs which hold the valves to their seats. If the suction pipe is continued, as shown by dotted lines, it will prevent sediment from being washed down into the pump. It will also retain water in the receiver when the machine is to be laid up for the summer, but a ¾-in. drip pipe can be tapped into the lowest part to draw off this water.

Fig. 6 illustrates a peculiar receiver which is set low in comparison with the duplex pump used. Water is drawn from the bottom of this receiver into a suction chamber below the water cylinders, therefore this pump is not of the submerged-piston type. This style gives more direct water passages and the pistons draw the water satisfactorily because there is but a very low lift. For a high lift the submerged-piston pump is preferred. This receiver is of cast iron, made in what appears like two parts, although they are cast together. The front part is circular, while the rear is enlarged, as shown. This has a flat top covered by a cap made in two pieces. The upper carries the mechanism by which the pump is operated, while the lower is to be removed for cleaning the inside.

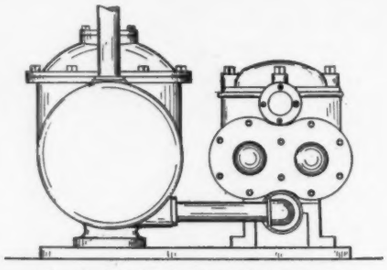


Fig. 6—Easily Accessible Receiver.

Fig. 7 is a vertical receiver that is partially supported by a single pump to the frame of which it is bolted. It also rests on a cast-iron post which stands on the baseplate common to both pump and receiver. When the upper head is removed the entire inner surface is exposed to view, thus rendering it easy to clean. This is one of the very few combinations of this kind that include but one single pump. If that fails to work the whole heating system must be shut down until repairs are completed. This demonstrates beyond dispute that the manufacturers of this pump believe that it will go and pump water whenever steam is turned into the steam chest at reasonable pressure. All makers of single pumps claim that, owing to their improved valve gear, the pump will run very slowly without stopping and when it is stopped it will start again readily from any point in the stroke. This claim is made with the expectation that the pump will be located in some boiler-room where it will be under the direct care of the fireman, hence if it does stop occasionally he can move some part of the valve gear by hand with little trouble and water will be supplied. When the same firms are given a chance to locate a pump and receiver in the bottom of a pit where it will seldom be seen and never taken care of properly they usually supply a duplex pump. Fig. 7 is an exception to the general rule, for the firm that makes it has no other kind of pump to sell except the single type and therefore its use in connection with a receiver shows that they believe in it fully. This pump is designed with a direct connection between the piston rod and the steam valve.

Fig. 8 is another receiver that is used in connection with a single pump. It is not large in diameter nor long, but is elevated above the pump. It is fitted with a dead-weight safety valve. This is practicable because only a light pressure is allowed and a leverage on the valve is not required. The valve gear of this pump has no direct outside connection with the piston rod, yet the makers install these machines wherever heating systems require them.

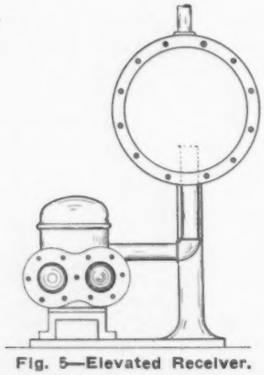


Fig. 5—Elevated Receiver.

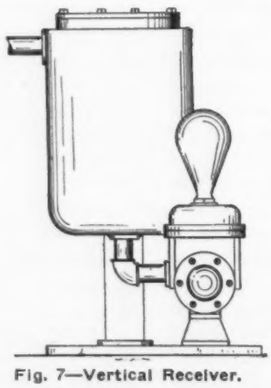


Fig. 7—Vertical Receiver.

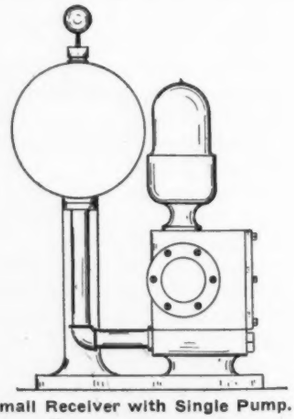


Fig. 8—Small Receiver with Single Pump.

ABSTRACT OF N. E. L. A. CONVENTION PAPERS AND DISCUSSIONS

ABSTRACTS are given below of all the papers and committee reports presented at the annual convention of the National Electric Light Association held this week in the Engineering Societies Building, New York City, with the exception of those presented at the sessions of the accounting section, which will appear in a later issue. When a paper or report was discussed a résumé of the remarks follows the abstracts. The abstracts are grouped so far as possible according to subject without regard to the order of presentation. The running report of the convention, printed elsewhere, presents the events in the order of their occurrence, and includes some subjects not taken account of in this section, such as special addresses, social features and other matters not associated with the presentation and discussion of formal papers and reports.

Association Affairs.

THE LIBRARY.

Mr. Arthur Williams, general inspector of the New York Edison Company, in his report as chairman of the library committee, stated that the library is in constant receipt of reports and documents of great value for reference, which applies particularly to the reports of kindred or affiliated societies and to the publications issued by the various public service commissions. As these commissions become more numerous it will be necessary to give closer attention to their records, and also to the general literature pertaining to public-utility regulation. Taking up the question as to how far the N. E. L. A. shall go in building up a library of its own, it is pointed out that there is already in the Engineering Societies Building the finest engineering library in the world. This library is peculiarly weak in the literature of social economics as related to utilities, and the committee suggested that such societies as the N. E. L. A. should contribute a small sum, possibly $250 a year, which should be devoted by the Engineering Library to the purchase of literature dealing with public-utility industries and their public relationships. In this way there would be built up a new and valuable section. The Engineering Societies do not feel justified in creating it, as their funds are already too limited for purchasing all that is of a strictly engineering nature. Over this section there might be some little control, and incidentally it might give the National Electric Light Association an influence with regard to the library which it does not now possess merely as a tenant in the Engineering Societies Building.

WATER-POWERS AND THEIR GOVERNMENTAL CONTROL.

The report of the conference called by the Power Transmission Section, and held in New York April 8, was presented at the convention in the form of a pamphlet of ninety-six pages, and consists of a verbatim transcription of the addresses by the various speakers at the conference and of the discussions which followed.

SECRETARY'S REPORT.

In his report, Mr. T. Commerford Martin stated that last year not less than 7000 copies of the *Transactions* in two volumes of the 1910 *Proceedings* were distributed. Editions of the *Bulletin* now run about 10,000 copies monthly, and single issues have contained over 100 pages, the large size being largely due to the increased matter contributed to the Question Box. The revision of the Question Box has been completed and put in type, and will be issued immediately after the close of the convention. Standard classification accounts have been put in book form and issued free to Class A members in leather binding. A large number of extra copies in cloth have been sold at about cost to all applicants, with the object of familiarizing the entire art with the classification. Three thousand copies of the revised edition of the Electrical Solicitors' Handbook were issued during the year, nearly all of which have been distributed. The secretary announced that the executive committee of the Northwestern Electric Light and Power Association has voted in favor of affiliation with the N. E. L. A. It is pointed out that owing to the increase of work the association, like its three sister national engineering bodies in the same building, will at no distant date require practically the whole of the floor on which it is now located.

REPORT OF MEMBERSHIP COMMITTEE.

The report of the membership committee, H. H. Scott, Doherty Operating Company, chairman, showed that the total membership on May 30, 1911, was 8665, a net gain of 3243 members during the year, or a gross gain of 3919. The membership is distributed as follows: Company members (Class A), 958; company individual members (Class B), 6654; Class C members, 19; Class D members (manufacturers and dealers), 226; Class E members (Class D individual members), 808. Of Class B members 5440 out of 6654 belong to company sections. On May 25 there were 39 company sections, including all of the sub-sections of the New York Edison and associated companies. There are now seven geographical sections, namely, Georgia, Mississippi, Nebraska, New England, Pennsylvania, Canada and Eastern New York, having a total membership of 2524. The commercial section has a membership of about 1000, and the power transmission section a membership of 17. The membership committee suggests the advisability of changing its name to the "committee on the organization of the industry."

QUESTION BOX REVISION.

The committee on Question Box revision, Mr. Alexander J. Campbell, chairman, in submitting its report said that the work of revision of the Question Box had been done by twenty-six associate editors. Owing to the revision being limited to consideration of questions and answers in past issues of the Question Box, the book will not be as complete as would otherwise have been possible. Critics were reminded that the editors consider that the issue of the present revision is merely the first step toward the issue by the association of a comprehensive handbook covering all phases of engineering and operation connected with central-station work. While there are many engineering handbooks available, very few cover operation at all adequately, and the editors have felt that no men in the country were better able to supply the deficiency than members of the association. The committee joined in the recommendation of the editor of the Question Box, that the association should engage the services of a competent man to issue the *Bulletin*, including the Question Box, but would add the further recommendation that he shall have the title of editor of the association publications, and that his work shall include the second revision of the Question Box.

DISCUSSION.

In reply to a question, Mr. Campbell stated that the size of Question Box revision would be that of the *Bulletin*. Mr. Pen Dell, Chicago, suggested that it would be well to make all publications of the association of the size of the *Bulletin*, as he has found that the Solicitors Handbook, which is of small size, is rarely carried in the pocket, as they do not wish to let the customers know that they are referring to a handbook for information. In reply to a question, Secretary Martin stated that the revision would cover about 400 pages. In late discussions much opposition was manifested against the suggestion to enlarge the size of page of the handbook.

THE QUESTION BOX.

In his report as editor of the Question Box, Mr. M. S. Seelman, Brooklyn Edison company, recommends that the association shall engage an assistant to the secretary, who shall attend to all correspondence relating to that feature of the *Bulletin* and gather, compile, arrange, edit and issue the *Bulletin*, including the Question Box. He does not consider it reasonable or necessary for the association to impose, as at present, on a member company the expense and responsibility of the work. Aside from the expense to a member company the conduct of the Question Box involves too much labor for any one man to assume in addition to his regular work as an employee of the company.

ELECTRICAL SOLICITORS' HANDBOOK

Mr. Arthur Williams, general inspector of the New York Edison Company, reported, as chairman of the "Solicitors' Handbook" committee, the features of the new edition of the "Handbook." The sections on the electric vehicle and illumination were thoroughly revised and considerably extended, and much new data introduced in the sections on load and diversity factors. A number of tables are included giving the ratings, specific consumption and other operating characteristics of incandescent and arc lamps and gas lamps. Thus far 10,500 copies of the "Handbook" have been distributed. The price of the new edition is $1 to members who have a copy of the first edition; to other members a copy will be mailed free.

COMPANY AND SECTIONAL BULLETINS

The report of the committee on company and sectional bulletins, Mr. E. A. Edkins, Commonwealth Edison Company, Chicago, chairman, gives an interesting account of the origin and growth of the bulletin idea. More than 500 house organs are now issued in this country at an expenditure of more than $2,000,000 per year. As examples of circulation it is stated that the Metropolitan Insurance Company distributes 5,000,000 copies of its organ each month, while the John Deere Plow Company distributes more than 1,000,000 copies of *The Furrow* every quarter. The first publication in the central-station field was the *Edison Monthly*, the first issue of which appeared in January, 1902; this has a circulation of about 25,000 copies monthly, though special editions may reach 50,000 copies. The next publication of the kind to be founded was the *Electric City Magazine*, the first number of which appeared in April, 1903, under the name of *Chicago, The Electric City*. This publication was first printed and circulated in the interest of the Chicago central stations, but at present the publication is supplied, with local matter substituted for that appearing in the Chicago edition, to central stations in thirty-seven cities and towns. Central-station bulletins under various names are now published in New York, Louisville and Chicago, and in the past have been published in Brooklyn, Portland, Ore.; Cleveland, Newark, Dayton and Buffalo. In addition, there are bulletins published for the benefit of central-station employees in Brooklyn, Boston, Seattle, San Francisco, Philadelphia, Denver, Toronto and Chicago, in some cases under the auspices of a company N. E. L. A. section. Mr. Edkins expressed the opinion that every N. E. L. A. sectional organization, however small, should be represented by a bulletin, than which there is no better agency for the upbuilding of membership in the association. He recommended that the association should do everything in its power officially to encourage the smaller member companies to follow the example of the larger bodies and establish bulletins, as this will not only make for the growth of the association, but will confer many substantial benefits upon the companies and their employees.

COMPANY SECTIONS.

Following the presentation to Mr. C. T. Russell of the Doherty gold medal at the second general session on Tuesday afternoon, there was a discussion on the work of company sections. Mr. Joseph D. Israel, of Philadelphia, thought that good results could be secured in section work by having a prominent man outside the company ranks deliver lectures at the section general meetings. He considered it wise to divide the membership into departmental branches, each of which would have a regular monthly meeting, at which men within the company would deliver lectures accompanied, where possible, with experiments. Good results might also be secured by having exhibits at the general meetings, with demonstrations of the latest devices, some of which might be those sold by the commercial department, and others consist of engineering devices used in the operating stations or on the lines. The plan of a large membership committee divided into sub-committees to canvass for members had given very good results in Philadelphia. Another successful plan was to reward the members for suggestions or ideas to improve the company's service.

Mr. Ernest F. Smith, of the Commonwealth Edison Company, Chicago, sketched the lines of activity of the Commonwealth Company section. Outside of regular monthly meetings the time is equally divided between serious educational work and entertainment of a good order, all of which is furnished by company employees. There is a glee club of twenty members, and recently the presentation and discussion of several short papers was followed by a minstrel show, which not only furnished a great deal of entertainment, but resulted in substantial increases in membership. The most elaborate entertainment of the past season was in the form of a comic opera with ninety members in the cast, following which refreshments were served and ending with a dance in an adjoining ball-room. While the members pay their own dues, the company contributes generously to the support and development of the section in a number of ways that show its appreciation.

Mr. R. F. Pack, of Toronto, gave an account of the work of the company section in that city. At first men were urged to write papers on the work of their departments, but this plan did not work out well. The idea was then carried into effect of having a course of lectures on more or less general subjects, beginning with one by a doctor on "First Aid to the Injured," and subsequent lectures were given by prominent men on subjects of broad general interest. The result has been that the men now realize that the company is not trying to work them, but endeavoring to benefit them, with the consequence that they increase in loyalty to the company section and to the company itself. In referring to experience in publishing bulletins he advised every company, no matter how small, to start a bulletin, adding that it would be better to have a two-page monthly than a larger one quarterly. He remarked that two men are attending the convention at the expense of the Toronto Electric Light Company, one for sending in to the bulletin the greatest number of good suggestions and ideas, and the other because he contributed an excellent article on company management vs. municipal ownership. The bulletin also serves the purpose of enabling the company from time to time to give out announcements of its policy in such a manner that the rank and file of the employees assimilate the ideas and get into their minds the general policy of the company.

Mr. George W. Baily, of the Brooklyn Edison company, stated that since last year the membership of the Brooklyn company section has been increased 64 per cent. After several trials the policy was adopted of having a combined business and social meeting every month. It is the aim to have a speaker from the outside at the meetings, either a leader in the electrical fraternity, a man high up in city government or some representative citizen to deliver an address, which is usually followed by a paper on a commercial and another on a technical subject, after which there is some entertainment with refreshments. The result of this plan was that the attendance has varied from 75 per cent on stormy nights to almost 100 per cent on other nights. One feature looked forward to with much interest is the annual convention held at one of the seaside resorts immediately after the national convention, at which there are two sessions, one in the after-

noon devoted to business, and the other in the evening at which there is an address.

Mr. Pen Dell, of Chicago, stated that while the Commonwealth Edison branch had more than 1000 members, the North Shore branch, owing to its limited opportunities, had but 130, yet he felt that it was much better to have the two separate bodies instead of a combined body. At first the policy was to have all papers prepared by outsiders, but at present all papers are contributed by members. There are occasional musical entertainments.

Mr. Parker H. Kemble, of Toronto, formerly editor of the Brooklyn Company bulletin, spoke of the value of such publications, partly owing to bringing the work of each department before all the others, by means of which the organization is welded together. He believed it desirable to provide something in a lighter vein at meetings, in addition to the more serious features, and that getting some prominent man from outside to speak on a broad subject is one of the most successful methods of brightening up the men and spurring on their work. There is a tendency of sticking too closely to the technical or educational part in direct connection with company work. The idea should be to enlist some man of prominence to take a man's mind away from the little rut of everyday procedure.

Mr. F. C. Hendershott, of the New York Edison Company, gave an account of the New York company sections. He described the great success of the New York Edison section, which now has a membership of 1500, largely to the executive ability of Mr. Arthur Williams and to a very active membership committee which meets monthly and includes a representative from each of the associated companies and partly to securing good speakers at the regular meetings. The adoption of a section bulletin has been of great advantage, as have also the social features.

Mr. Joseph D. Israel, of the Philadelphia Electric Company, said that through the liberality of his company, and its president, Mr. McCall, there are fifty members of the company's section present at the convention at the company's expense, who were selected on the score of their attendance at section meetings. This was not held out as a reward, as the men did not know of the matter until last week.

Mr. Martin J. Healy, of the Buffalo General Electric Company, gave an account of the experience of the Buffalo section. He said the greatest difficulty was to get linemen to talk, those who attend the meetings in the greatest number being members of the meter, contracting and auditing departments. The attendance is very much larger when there is a banquet or similar entertainment. In reply to a question Mr. Arthur Williams stated that the dues of all the branches are $5 a year, which entitled a member to all advantages of membership in the national association. He favored the idea of a company advancing the association membership dues, the employees repaying the same on the installment plan.

President Freeman referred to an inquiry made regarding the admission of other than company employees into company sections. It had been suggested that it would be valuable to have a sort of relationship between electrical contractors and company employees, but at present there is no provision in the constitution to allow this. He said, however, that he understood an amendment was under consideration.

Mr. M. S. Seelman, Jr., of the Brooklyn Edison Company, called attention to the fact that the New York company section was formed too late to enter into the medal competition. Referring to the size of bulletins he said he thoroughly believed it better to confine matter to a brief than to a large space, and he believed in reducing the size of bulletins, so far as possible, in order to secure the largest number of readers. He spoke of the value of company sections through affording a means of contact between the men and those who control and direct. He suggested that at section meetings queries and answers from the Question Box might with benefit be discussed. He said that there is a volume of live matter on every phase of central station activity within the covers of the Question Box.

Mr. Farley Osgood, of the Public Service Electric Company, Newark, stated that his company section had about 130 members. The reason why it is not larger is that the men are distributed from Jersey City as far south as Camden, and therefore they cannot easily get together at meetings. The company donates $500 to the company section so that it is necessary for the men to pay only $2.50 for annual dues. The experience with linemen has been the same as at Buffalo, but the plan for the future is to have papers that will interest outside construction men in order to attract them. The reason why meter men and commercial men are more regular in attendance is because they are accustomed to talk through meeting the public, and thus are not timid about speaking at meetings.

Mr. Bayard W. Mendenhall, Utah Light & Railway Company, said that Salt Lake City had met the same difficulty as that referred to by Mr. Healy, of Buffalo, and Mr. Osgood of Newark. The method was then adopted of distributing many questions from the N. E. L. A. bulletin, and then calling on them for answers at meetings, which had proved successful.

Mr. Samuel Insull said that the company sections had rendered a great service, not only to the association, but to the companies and to the industry. Personally he considers that the company section has been one of the most desirable factors brought into the central-station business. Nothing contributes more to the esprit de corps, that results in a close feeling of relationship and loyalty to the organization, than the establishment of company sections. That the greater part of company-section membership is among the larger companies is to be regretted, for this class of work can be extended right down to the smallest organization that has membership in the N. E. L. A. If the association is to maintain its virility it will have to look to the company sections, and some scheme should be devised to obtain representation of such sections at the national convention. He doubted if it would be desirable to admit to section membership employees of electrical contractors or allied industries. The aim should be to bind together the employer and employee, and there is no method of bringing about that result more certain than so to educate the foreman or lineman as to enable him to occupy an executive position. This has been done in the steam-railroad business very extensively, and to-day a great number of the trunk lines of the country have as executive heads men who have worked in section gangs, and there is no reason why similar results should not be brought about in the central-station business. No way of doing this is better than through the encouragement of company sections, and he believes that the main effort of next year's administration should be in this direction.

It was difficult, he said, to get men together in the evening who have worked hard all day, unless some form of entertainment was provided. A fair estimate of the number of employees of central-station companies is 100,000, and if, following the experience of Brooklyn, New York, Chicago and Philadelphia 40 per cent of these were to become members of company sections spread over the country, the effect in molding public opinion would be very great. Subjects relating to generating and selling price, relations of capital and labor, relations of the community to the business, the serious effect upon companies of adverse relations—all these matters could be discussed in the company branches, either by men inside or outside of the organization.

In conclusion Mr. Insull said that he believed it to be of vital importance, alike to the National Electric Light Association, its company members and its employees, vigorously to encourage the formation of company sections in all parts of the country.

Apparatus, Electrical and Steam.

LOAD FACTOR AND CENTRAL-STATION EQUIPMENT.

In a paper entitled "The Relation of the Modern Load to the Station Equipment," Mr. F. D. Newbury, Westinghouse Electric & Manufacturing Company, considers the effect of loads of various kinds on the station equipment, and discusses the adaptation of station equipment to meet the requirements imposed by such loads. The paper contains data giving the approximate power-factor of various loads, ranging from incandescent lamps connected with small transformers, through induction motors, rotary converters, synchronous motors, to arc and induction furnaces and electric-welding transformers. Of all the apparatus the only kind which affords any control over the power-factor is the synchronous motor. In case of low power-factor such motors have been installed running without energy load, in which case they act as condensers, causing a leading current to circulate. It is, however, more economical to utilize a synchronous motor for energy load as well as for regulating purposes. Examples are given to illustrate the method of determining the proper size of synchronous motor to effect a certain improvement in the power-factor.

The effect of instantaneous current demand on station capacity is treated, and cases are pointed out where it would be undesirable for a central station to take on certain loads unless adding also motor-generator sets or separate feeders. In treating of arc-lamp load, it is shown that the power-factor of a direct-current open arc, the machine being driven by an induction motor, is 90 per cent; of the alternating-current inclosed-arc lamp with current transformer, 75 per cent, and of the direct-current metallic-arc lamp with rectifier, 65 per cent. In considering combined lighting and railway loads the author concludes that in a great majority of cases the rotary converter can be used to greater advantage than a motor-generator set, particularly in view of recent improvements in the former involving fewer poles, permitting a wide range of brush position without sparking and flashing, and with higher commutator peripheral speed, permitting more commutator bars per pole. Discussing the station equipment to meet the requirements of its specific load, stress is laid upon the importance, in alternating-current generators having plenty of margin in excitation voltage, of enabling the generator to hold up in voltage under unusual load conditions. To secure uniformity of voltage two classes of regulators have been adopted, one being used to hold a constant voltage at the terminals of the generator and the other—a single-phase feeder regulator—to hold a constant voltage at the ends of the respective feeders that may be supplied by a single generator. It is stated that the use of the latter, which is compact in design and requires very little floor space, has been increasing by leaps and bounds during the past two years.

Modern generators suitable for operation with automatic regulators, and which will safely withstand accidental short-circuits, require proportions antagonistic to a low percentage inherent regulation, the desideratum being a generator designed with sufficient leeway in exciting voltage to hold up voltage safely under all conditions of load and power-factor that will be met in operation. In modern generators the instantaneous short-circuit current may vary from fifteen to fifty times the normal current, and since the forces acting between conductors vary with the square of the current the armature-rupturing forces under short-circuit are tremendous, which explains the very rigid bracing required by the larger turbine-driven generators and also explains failures in such generators under extreme conditions or when adequate coil bracing has not been provided. Additional external apparatus, such as auto-transformers or choke coils, have been proposed for protecting large generators from the destructive effects of short-circuits, but their use is only advisable when it is impossible so to construct the generators that they will in themselves stand the service requirements. It has been found by experience that all ordinary generators, if designed with comparatively high-armature self-induction and an adequate system of coil bracing, will safely withstand even the enormous shocks of short-circuits, and it is only with generators of extreme size, or in cases of frequent or severe short-circuits, such as are encountered in power stations having grounded alternating-current railway systems, that external safeguards have been found necessary.

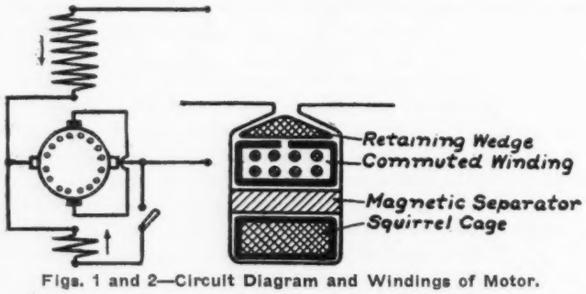
DISCUSSION.

Mr. H. L. Wallau, Cleveland, cited a welding installation supplied by motor-generating set rated at 400 kva at 50 per cent power-factor. The motor was a 210-hp synchronous machine. The average load was about 60 kw, but the peak demands were so great that the circuit-breaker on the low-tension side of the machine would open at 1600 amp. When the breakers were set higher the motor was pulled out of synchronism. Mr. Newbury confirmed this statement and suggested that the only satisfactory way to take care of welding loads is by separate motor-generator sets. Mr. P. M. Lincoln also concurred with the foregoing statement, and suggested that probably better results could be secured by driving the generator in question by an induction motor with possibly some flywheel effect on the outfit.

RECENT IMPROVEMENTS IN SINGLE-PHASE MOTORS.

In a paper with the above title Mr. W. A. Layman, vice-president of the Wagner Electric Manufacturing Company, gave descriptions, accompanied with illustrations, of a new form of constant-speed, single-phase motor with an improved power-factor, and of a high-power-factor, adjustable-speed, single-phase motor comparable with the well-known adjustable-speed, shunt-wound, direct-current motor. The stator or field and the rotor of the new constant-speed motor have each two windings. The main stator winding produces the initial magnetism, as heretofore, while an auxiliary winding controls the power-factor and compensates the motor. Of the two windings of the rotor one is of the usual squirrel-cage type and occupies the bottom of the rotor slots, the second, or auxiliary, winding is connected to a standard form of horizontal commutator and occupies the upper portion of the rotor slots. Between the two rotor windings is placed a magnetic separator in the form of a rolled-steel bar.

Two sets of brushes are provided, of which the main pair is placed in the axis of the main stator winding and is short-circuited, an auxiliary pair being placed at right angles to the axis of the main stator winding and connected in series with it



Figs. 1 and 2—Circuit Diagram and Windings of Motor.

at starting. The auxiliary stator winding is permanently connected to one auxiliary brush and is adapted to be connected to the other auxiliary brush by means of a switch. The purpose of the peculiar rotor construction and of the brush arrangement and connections is to accentuate at starting the effect of the squirrel-cage winding along the axis of the main stator winding while suppressing it, so far as possible, along the axis at right angles thereto. The magnetic separator tends to suppress the effect of the squirrel-cage winding along all axes by making it less responsive to outside inductive effects. The influence of the separator is, however, nullified along the axis of the main stator winding by the presence of the short-circuited brushes, while no means are provided for nullifying its effect along the axis at right angles to the main stator winding. As a result, the main stator winding will be able to

induce heavy currents in both rotor windings, because of the short-circuited brushes and in spite of the magnetic separator, while the rotor winding connected in series with it will not be able to produce heavy currents in the squirrel-cage winding along the axis because of the magnetic separator, which shunts or side-tracks the intensified magnetic flux. The accompanying illustrations illustrate the above details.

The speed-torque curve of the motor is mainly composed of two torques, one of which is due to the interaction of the commutated and squirrel-cage windings in the main axis, with the commutated winding in the auxiliary axis; this torque is large at starting and diminishes with increasing speed. The other is due to the interaction of the main stator winding and squirrel-cage winding, which torque is zero at starting and increases very rapidly beyond a certain speed. The net result is a speed-torque curve which in the main is a rising one, reaching a maximum just below synchronous speed and becoming nil or nearly so just above synchronism. The paper discusses in detail the events in going from no-speed to full-speed and enumerates a number of features of the motor having relation to durability and reliability. Under tests the motor shows a remarkable constant speed at all loads.

The adjustable-speed, single-phase motor, to which the esecond portion of the paper is devoted, has been brought to a successful commercial stage by Mr. Val A. Fynn, of England; Prof. E. Arnold, of Germany, and Mr. J. L. la Cour, of Sweden, the object in view being to produce an alternating-current motor which fulfills every condition now met by the direct-current adjustable-speed motor. With a rated 3-hp motor of this type an adjustment of speed can be secured between the limits of 750 r.p.m. and 2250 r.p.m., yielding from 2 hp at lowest speed up to 5 hp at highest speed. The number of positive steps of control may be as many as desired within reasonable limits. The small percentage of slip between no-load and maximum load, on each step, is stated to be one of the very interesting features of the performance of this motor, and the very high power-factor under all operating conditions is especially noteworthy. The efficiency is fairly constant for all speeds within the working range of the machine. In conclusion the paper points out that both types of motors described impose upon a central-station system a load of substantially unity power-factor.

DISCUSSION.

Replying to questions, Mr. Layman said that at all loads the motor will take less current from the circuit than any motor with lagging power-factor. The starting torque is lower than at a high speed, the acceleration being less rapid, but the power-factor is higher at starting and the effect on the circuit is improved. The motor can be designed for a considerable variation of starting torque, depending on the exact ratio of the windings in the rotor slot and the magnetic characteristics.

Mr. John C. Parker, Rochester, congratulated the industry upon the possession of an adjustable-speed alternating-current motor of the type shown. The field of application is very large, notably in machine-tool work, where there is a large demand for high power-factor, high-efficiency, adjustable-speed alternating-current motors for the operation of air compressors and refrigerators under variable loads, particularly where the maximum-demand system is used. These characteristics are required in refrigerating and air-compressor service. There is also a demand for such motors in connection with centrifugal-pump and rotary-fan operation, where high efficiency of the driving apparatus demands that the pressure be secured at the desirable point of speed regulation. In conclusion Mr. Parker emphasized the importance of striving to accomplish satisfactory polyphase speed adjustment combined with high efficiency or a tolerable power-factor. Much is being done in this direction in Europe. It is admitted that commutation characteristics are bad in the larger sizes of adjustable-speed alternating motors, but this does not appear to have discouraged our European friends.

Mr. Layman closed the discussion by stating that this type of motor has been developed up to the 15-hp size. He felt that performances will be accepted abroad which will not be accepted here, and brought out the point that many new devices in Europe are sold by the manufacturers to themselves for trial in a separate corporation. He had seen large polyphase commutator motors operating in Europe, but the results were not those required in this country.

PRIME MOVERS.

The report of the prime motive power committee, Mr. I. E. Moultrop, of the Boston Edison Company, chairman, devotes attention largely to standard apparatus in use by the various member companies. As in the case of previous reports, the present one contains information of high practical value, presented in a well-digested form. It is stated that the stream turbine is rapidly reaching a standard which leaves very little room for criticism in the way of economy of operation or reliability of service. No new development has been found in gas-power apparatus and, as in the case of steam power, the general tendency has been toward the perfection of the apparatus. In steam-turbine work it has been found that the auxiliaries are subject to some criticism, and suggestions pertaining to the construction of steam turbines were submitted to several manufacturers in this country, replies from which are included in the report. It was found that there has been considerable trouble with condenser tubes, such as splitting, breaking, creeping endwise, etc., and an appendix contains statements from a number of tube manufacturers relating to condenser-tube troubles. There is also an appendix relating to the troubles connected with the circulation of water in surface condensers. Numerous other points are considered relating to the details of steam-power operation.

A paper by Mr. James E. Klumpp is included which contains information on the present status of gas producers, gas and oil engines, and gives a list of gas-engine installations compiled since the 1910 report. Another paper by Mr. W. N. Ryerson relates to water-power apparatus. Replies were received from 153 member companies using water-power from which information is abstracted relating to difficulties met with in operation, etc. A final appendix gives a description of a system for the ventilation of turbo generators. As in the case of former reports on motive power, the present report contains information of much value in a well-digested form.

DISCUSSION.

Mr. E. E. Gilbert, Schenectady, emphasized the necessity of clean air for the ventilation of generators.

Mr. John C. Parker, Rochester, approved of the increasing use of oil accumulators in connection with the governors of hydraulic turbines. Referring to the bleeder type of turbine, he said that there should be an increasing demand for this type not only for the supply of electrical energy, but in connection with the use of exhaust steam for heating purposes. Mr. Parker referred to a new type of gas engine which is now passing into use in Europe, and having an efficiency at least 10 per cent above the ordinary gas engine. Units of this type have been designed in size as high as 1600 hp, and it is said that it can be built cheaply. A considerable portion of the discussion was devoted to the consideration of the matter of erosion of steam turbines, which was largely ascribed to impurities carried over in the steam. Attention was directed to the desirability of rendering more rapid the dismantling for repair of turbines and auxiliaries.

Mr. R. D. DeWolf, Rochester, referred to the bleeder type of turbine and said that the bleeder turbine furnishes a solution of the problem of carrying properly the electric load and furnishing steam for exhaust heating.

Mr. Moultrop, in closing the discussion, said that attention should be called to the fact that in Germany and France gas engines are being built in ratings as high as 10,000 hp.

VENTILATION OF TURBO-GENERATORS.

In a paper by Mr. R. B. Williamson, of the Allis-Chalmers Company, Milwaukee, Wis., much interesting information was given concerning recent developments in the forced ventilation

of turbo-generators. On the basis of the specific heat and weight of air and the permissible temperature rise, the author showed that about 125 cu. ft. of air per minute is required for each kilowatt of loss. He stated that in many cases the weight of air required for ventilation of the generator is even greater than the weight of steam consumed by the turbine during a corresponding period of time.

The heat units in the discharged air represent from 3 per cent to 6 per cent of the total station output, and economy would dictate utilizing these units for some useful purpose,

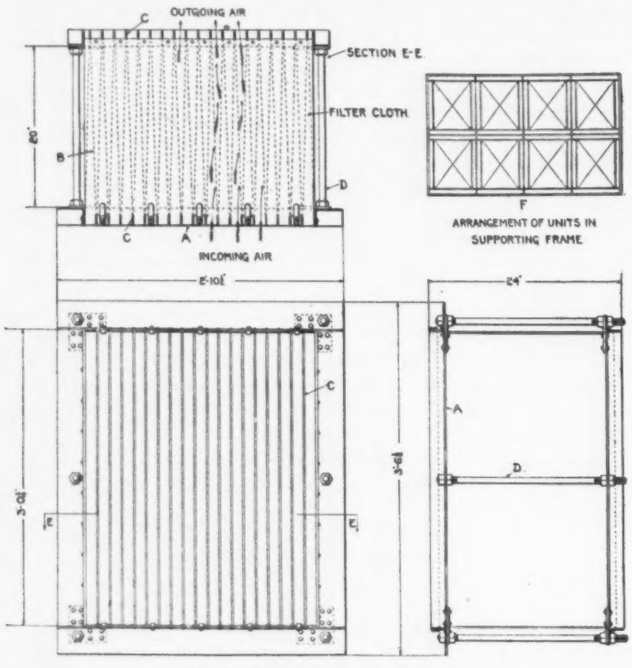


Fig.1—Filtering Arrangement.

such as preheating the air supplied to the boilers or maintaining a comfortable temperature in a factory. Arrangements are being made to accomplish the latter purpose in a large glass factory now being erected. The generating station is located alongside of the factory and the generators are arranged so

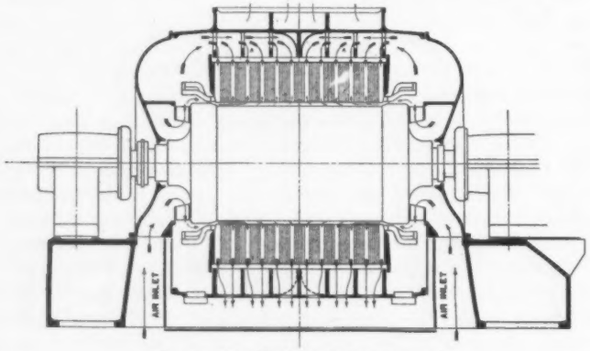


Fig. 2—Ventilating Arrangement.

that the air can be discharged either upward or downward, as described later. In summer the air can be discharged upward by removing a cover plate on top of the generator. In winter the outlet at the top of the generator can be closed and the air discharged downward into a large duct from which it can flow into the factory. The plant will ultimately have four 2500-kva units, so that between 400 kw and 500 kw stored in the air will be available for heating. This plant will run continuously at full load, so that a steady supply of warm air will be available.

On account of the large quantity of air required for ventilating a turbo-generator even a small percentage of dust soon results in a large amount of dirt within the machine. Numerous forms of air filter have been devised for cleaning the air. Fig. 1 shows a filter that can easily be made by stretching cheese cloth, cotton or thin flannel between two frames. The cloth *B* is passed around flat strips of galvanized iron *C* and is pulled taut by the nuts on the threaded studs *D* at each corner. The cloth is threaded back and forth, as shown, so that the air entering at *A* must pass through a large surface of cloth. The velocity of the air through the cloth is, therefore, very low and filter unit approxmiately 3 ft. wide, 3 ft. high and 2 ft. deep can pass 2000 cu. ft. of air per minute with an air velocity through the cloth not exceeding 10 ft. per minute. With this low velocity the filter does not throttle the flow of air to any great extent, and with the large area thus obtained the cloth will not become clogged up rapidly.

Many different plans have been used for passing the required amount of air through the limited passages within the machines, but the usual practice is to set up the air circulation by means of centrifugal fans at the ends of the rotating field structure. In some cases the air has been supplied by separate centrifugal blowers in the same manner that is customary for an air-blast transformer. This arrangement is advantageous in that the fan can be designed for the highest possible efficiency and the flow of air through the generator can be controlled at will, but is slightly disadvantageous in increasing the number of station auxiliaries.

The major portion of the heat to be dissipated is produced in or at the stationary armature core. According to a method of ventilation extensively used in both this country and Europe air enters intakes in each of the end housings and after passing through the fans flows into a chamber at the bottom of the stator yoke, whence it is forced through the ducts in the stator core and out at the top. The air divides into two streams, one-half passing up through the core on each side of the machine. With a generator of large diameter the paths for the air become long and the temperature rise correspondingly high.

For large, high-speed units a better method is the one illustrated in Fig. 2. Instead of passing all of the air up through the machine according to the two-path plan it is introduced behind the core through a number of inlets distributed around the whole periphery and after passing through the ducts is discharged into adjacent chambers. Several advantages are claimed for the multi-path method of ventilation for large machines. One-half of the outside circumference of the stator punchings is exposed directly to air from the fans and the stator is not dependent for its cooling on hot air that has already passed over the rotor before reaching it. The use of a number of short paths in parallel through the core greatly reduces the resistance offered to the flow of air, thus, for a given pressure, allowing a much larger quantity of air to be passed through the machine, or, on the other hand, allowing the use of lower pressure for a given flow.

DISCUSSION.

Mr. H. L. Wallau, Cleveland, referred to the necessity of purified air for ventilation, and suggested the use of a vacuum cleaner for removing the dirt from generators. Mr. R. F. Schuchardt, of Chicago, said that this plan is being carried out in a Chicago central station.

OIL-COOLED TRANSFORMERS.

A paper by Mr. H. O. Troy, of the General Electric Company, entitled "Recent Developments in Self-Cooled Transformers," opens with a review of the development of the transformer, particularly with relation to its cooling. Illustrations of various types of transformers are included, together with curves relating to efficiency and regulation. The present state of the art is then sketched, and it is pointed out that the recent increase in the range and capacity for which self-cooled transformers are now built is due in part to the demand for such transformers and in part to improvements in transformer steel and methods of mechanical construction which have made new forms of tanks practicable. These advances in the art have extended almost indefinitely the range of capacity for which self-cooled transformers can be built. In summarizing his paper the author states that the development of the self-

cooled transformer in recent years is not inherently different from the development of the water-cooled transformer except in the development of a cooling system. The thermal problem involved in water-cooled transformers so far as case and coil structure are concerned has been solved up to almost any capacities required and the insulation problem solved up to any voltage which can be successfully transmitted. Actual transformers up to 14,000 kva have been developed, and the voltages they actually transmit up to 140,000. The only additional problem involved in the self-cooled transformer, namely, the cooling system, may be said to have advanced as far as at present required by the demand for large capacities. If the demand of the future required even greater capacities than those now under consideration it can no doubt be met by the further development of some of the cooling systems illustrated in the paper, or possibly by some form of cooling system which places a portion of the radiating surface external to the building in which the transformers are housed.

DISCUSSION.

The brief discussion on this paper was confined to a definition as to what constitutes radiating surface.

DEVELOPMENTS IN ELECTRIC APPARATUS.

In the report of the committee on electrical apparatus, of which Mr. L. L. Elden, of the Edison Electric Illuminating Company, was chairman, brief discussions were given of the newer types of generating and auxiliary equipments, including relays, instrument transformers, polyphase transformers, auto-transformers, motor-generators, storage batteries, feeder regulators, mercury-arc rectifiers and lightning arresters.

Much attention was paid to the use of reactors to limit the current produced by generators on short-circuit. In the case of the 20,000-kw units for the Commonwealth Edison Company the series reactance limits the short-circuit current to from twelve to fifteen times the normal full-load current. The reactance is formed largely in auto-transformers used to increase the generator emf of 4500 volts to the busbar emf of 9000 volts. By use of a 4500-volt generator in the auto-transformers rather than a 9000-volt machine without transformers the normal efficiency is not lowered, while performance under abnormal conditions is much improved.

As a result of short-circuit tests made upon certain 12,000-kw generators the committee recommended that the use of reactance to limit the short-circuit current be given the most careful consideration. Reactance should be inserted in series with the armature of low-reactance turbo-generators, while all new equipment should be purchased with as high reactance as is compatible with good design.

DISCUSSION.

Referring to fires from transformer oil, Mr. W. F. Wells, of Brooklyn, said that a plan might be devised whereby in case oil accumulates in concrete floors they can be flooded with water, a drain being provided to carry off the mixture of oil and water. In case of air-cooled transformers he suggested placing fuses over the top, so that as soon as the flame commences to come out the fuse is melted and the ventilating motor automatically shut down.

Mr. F. D. Newbury, Pittsburgh, said that turbo-generators can be built with sufficient internal reactance to avoid the use of external reactance. As to coil bracing, with good reactance the damage can be limited by the use of effective bracing. As to low-speed versus high-speed machinery the latter is the cheaper, but he believed that quiet operation is as possible with the high-speed machine, provided the apparatus is properly inclosed.

Mr. Schuchardt said that a recent long series of tests in Chicago had given rise to a greatly increased confidence in oil switches.

Mr. E. M. Hewlett, Schenectady, stated that changes are being introduced in the bellows-type relay in order to render it more selective. Mr. Moultrop stated that the present form of relay is selective for grounds, but not for short-circuits.

Mr. H. L. Wallau, of Cleveland, agreed with Mr. Moultrop in stating that in the case of grounds there is selective action, but not in the case of short-circuits.

Power House Design and Operation.

COST OF ENERGY FROM STEAM.

A paper by Messrs. G. H. Walbridge and E. M. Gilbert entitled "Method of Determining the Cost of Steam Power Under Various Conditions" was presented by Mr. Walbridge, of the Central Colorado Power Company, Denver, Colo. The paper was devoted to the description of curves devised for showing the factors which control the cost of steam energy in the various parts of the territory covered by the circuits of the transmission company in Colorado. Curves were plotted to show the relation between the pounds of coal per kw-hour and the cost of coal in mills per kw-hour for different types and sizes of engines. There was also shown the cost of boiler room labor in dollars per kw-year as affected by the pounds of coal required per kw-hour. In a separate set of curves was shown the cost of banking in mills per kw-hour as affected by the cost of coal in dollars ped kw-year; there was also shown the relation between the cost of engine room labor in mills per kw-hour as affected by the kw rating of the station The opinion was expressed by the authors that the curves should prove useful for rapid and rough approximations in cases where an engineer is not well supplied with other data.

This paper was not specifically discussed, although the facts mentioned in the paper were covered indirectly in a general discussion on the operation of transmission systems which followed.

FUEL OIL FOR STEAM BOILERS.

Mr. Herbert A. Wagner, Baltimore, described the system employed by the Consolidated Gas, Electric Light & Power Company in its Westport station for using coal and oil simultaneously for fuel for its boilers. The space under the boiler back of the usual coal grate is made into a large combustion chamber with the oil burners at the extreme rear end. This chamber is separated from the boiler tubes above it by tiling and from the coal grate by a low bridge wall. The coal grates are 14 ft. wide and 8 ft. long. Each furnace is provided with four oil burners. Oil is delivered to the boilers under 20 lb. of pressure per square inch and is atomized in each boiler by means of a steam jet.

Under actual operating conditions the maximum boiler outputs obtained during seven hour runs have been as follows: With coal used alone, 1188-hp.; with oil alone, 702-hp.; with coal and oil together, 1445-hp. It was found that a 2000-kw station load can be carried by each boiler when using coal and oil together with as much ease and certainty as 1200-kw per boiler can be carried when coal is used alone. The results indicate a gain in output of 66 2-3 per cent by the use of the oil or a saving of 40 per cent in the cost of the boiler equipment for a given output.

The cost of oil for producing a certain amount of steam is about 33 per cent more than that of coal. In spite of this difference in cost of fuel, the actual cost of banking is less with oil than with coal for the reason that the oil is burned efficiently while the coal is necessarily burned very inefficiently. The author stated that a saving in investment and in labor for peak load can be effected by the use of oil. Fuel oil shows its advantages as compared with coal most markedly when used as fuel for operating steam plants in connection with long transmission lines receiving energy from hyrdo-electric stations.

The paper contained considerable data relating to the use of fuel oil as compared with coal. From this data it was shown that the cost per month for fuel and labor for boilers to keep 10,000 kw in reserve at full steam pressure and ready to take the load equals $1,600 with oil and $3,126 with coal.

DISCUSSION.

A written communication was received from Mr. M. G. Kennedy, of the Syracuse Lighting Company, Syracuse, N. Y. Mr. Kennedy outlined the conditions in Syracuse, where the lighting company operates under a contract with the transmission company to receive nominally 6000-hp with penalty for a peak load exceeding 7400-hp. The company possesses a 4950-kw steam relay sub-station; the steam is used only for peak load and for an average of six hours per day. However, during off-peak hours, two 1500-kw turbo-generators are kept floating on the system in readiness to assume the load in case the transmission supply is interrupted. The generators are over-excited to act as condensers. Reverse power relays are used to prevent the transfer of energy from the steam station to the transmission line in case of interruption to the transmission supply.

The steaming equipment consists of twenty-two 330-hp Heine water-tube boilers, nine of which are equipped with fuel oil burners, the others being arranged for coal fuel. The oil fuel boilers are kept only for emergency conditions, but are maintained hot at all times by means of live steam introduced from the other boilers. Each standby boiler is equipped with one oil burner at the end of which a gas pilot flame is kept burning at all times. When the transmission service fails, the oil burners are placed in service at once without any interruption to the local distribution of energy. Mr. Kennedy stated that the scheme of operation employed is not ideal, but it has prevented discouraging interruptions to the service and, on the whole, the result has been more successful than was expected.

Mr. W. L. Abbott, of the Commonwealth Edison Company, Chicago, endorsed the suggestion of the author concerning the use of oil fuel for carrying peak loads and for banking purposes. He expressed the opinion that when used for banking the result should be a saving of, say, one ton of coal per day on a 500-hp boiler.

SCIENTIFIC MANAGEMENT.

Mr. L. D. Webster, of the Marion Light & Heating Company, presented a paper entitled "The Posibilities for Economy in the Operation of Light and Power Companies Offered by Scientific Time Study," which gives the result of a study in the scientific management of power houses based upon the records of a public-service corporation operating a number of electric-light and power companies in cities of from 5000 to 150,000 in the Middle West. Charts accompany the paper illustrating the method of handling the data secured. The case was cited of a plant having eighteen firemen working in three shifts firing boilers which during the peak load were driven at from 100 per cent to 150 per cent above the normal rating. One man fired 600 hp of boilers, and notwithstanding the handicap of overloaded boilers and poor fuel the eighteen firemen were found, upon tabulation of the observations, to have worked on an average of only 47½ per cent of the time. This result was largely due to lack of proper instructions and neglect of working details, such as proper tools and the style of fire-doors. In another plant an examination of operating records disclosed the fact that the output of useful work for firemen had fallen off from an average of 477 tons of coal per man in January, 1909, to 334 tons in January, 1911. Here it was found that the prevailing sentiment among the men was that they considered they were doing as much work as a man should be asked to do, and that they could not get any better results in economy if they worked harder. This is cited as a practical illustration of the natural tendency of the laboring man to give a diminishing return for his wages when the supervision over him is relaxed ever so slightly.

Experiments were made in connection with economy tests on the boilers of this plant to find out just how much work was necessary to fire the boilers when driven at various ratings, and the results are submitted in tabulated form. These show that an increase of over 50 per cent in the quantity of coal fired was made, with an increase of only about 25 per cent in that portion of the fireman's time spent in work. Curves are given showing that a very considerable part of the fireman's working time is spent in opening and closing furnace doors, picking up and laying down tools, leveling fires, etc. Any action taken by the management of a plant toward increasing the ease of operation of doors, etc., the placing of coal and tools where they can be reached with the least possible effort, together with the offer of a premium or bonus when the rate of driving is kept at the most economical standard will not only result in an increase in economy of the boiler plant, but a decrease in the labor cost per ton of fuel handled. An account is given of a similar examination of the work of an engine-room force which showed that not only were the high-priced men on a shift idle a large percentage of the time, but that in order to keep busy they were doing a good share of the work properly belonging to the cheaper men under them. In one plant 32 per cent of the engineer's time was spent on his own work, 25 per cent on cheap men's work and 39 per cent in doing no work; in another case these figures were respectively 8 per cent, 24 per cent and 57 per cent.

Investigation showed that the field for scientific time study was even greater in the distribution department than in the power house. Data and curves were given relating to the disposition and amount of time spent in fastening cross-arms and iron-top brackets on new poles, which indicate a low efficiency of labor. In conclusion the author said that in the reorganization of power-house and line forces, and the bringing of the work of a man up to as near 100 per cent efficiency as possible, it is wise in order to avoid a discontented working force with possibility of strikes, after eliminating such men as were found from observation to be unnecessary, to give the remaining men a percentage of the saving effected.

DISCUSSION.

Mr. H. Fitzjohn Porter, efficiency engineer, said there were ample data on the time required to shovel coal as regards the mere transfer of material. But when it is necessary to fire this coal under boilers with an idea toward high steaming efficiency, so many variables may enter into the problem that the efficiency of demand is difficult to obtain. Unless these variables can be held constant, the data will be deceptive and so worse than useless. In making test experiments to determine the productiveness of certain classes of labor, care should be taken not to over-fatigue the men to a point at which they cease to be continually productive, although the men themselves may be unconscious of this overwork.

POWER HOUSE LOAD REPORTS.

Mr. A. S. Loizeaux, of the Consolidated Gas, Electric Light & Power Company of Baltimore, presented a paper entitled "Load Reports of an Electric System," which describes the system of station-load reports employed by the company with which the author is connected. Numerous forms accompany the report. The subject is treated under the heads of log sheets, record books and reports. Of the latter there are described and illustrated forms for daily-output summary, special day-load curves and large customers' monthly reports for kw-hours generated and purchased, kw-hours sent to commercial lines, load statement, graphic load record, daily maximum peak and maximum output yearly report of kilowatt statistics, peak loads, load-factors and continuous reports. Information is given as to the method of keeping the log sheets and record book.

DISCUSSION.

In the absence of the author, the above paper was presented by Mr. Douglass Burnett, of the Consolidated Gas, Electric Light & Power Company, of Baltimore. Mr. N. J. Neall, Boston, said that the curves of load on central stations become of greater and greater importance, and will be especially valuable when in the future the utilization of water-powers becomes necessary and curves are called for to determine whether the operations of an electric company are compatible with old-time practice. He stated that load curves and other data should be collected by the proper committees of the Association, with

the idea of obtaining characteristic curves in order that members at large may have an authoritative reference file indicating the present status of electrical operations, and also the various kinds of service constituting different load-factors, etc. Chairman W. C. L. Eglin, Philadelphia, remarked that to carry out this suggestion of Mr. Neall would involve an expenditure of many thousands of dollars, but he expressed the opinion that it might be well for the Association to attempt to obtain a standard form of load sheets.

Mr. Farley Osgood, Newark, suggested that some suitable person should present at the next convention of the Association a paper relating to the general characteristics of load curves which would contain the information requested by Mr. Neall. The chairman expressed the sense of the meeting as a desire for the Association to endeavor to prepare standard forms of load reports and also indicate characteristic load curves.

CENTRAL-STATION ENERGY SUPPLY FOR RAILROADS

Mr. Fred Darlington, of the Westinghouse Electric & Manufacturing Company, presented a paper entitled "Central Power Plants and Electricity Supply for Trunk-Line Railroads" in which arguments were presented to show that energy generation and railroading should be conducted as independent undertakings, and that electrical energy for all purposes, including manufacturing, lighting and railroading, should be supplied from the same central stations. The author's arguments were based on decrease in cost per kw-hour with increase in size of generating station and improvement in load-factor by diversity of requirements for energy. He claimed that the largest and best steam locomotives are merely relatively poor portable steam-engine plants limited in service output. By means of multiple-unit operation the output of electric locomotives is practically unlimited and concentrated generation of the energy and transmission where needed is the best solution of the problem of the operation of the electric units. The author contended that central-station men should co-operate with the railroads to furnish them with electrical energy for operating their trains.

DISCUSSION

After reading his paper, Mr. Darlington pointed out that when the time comes to deliver energy in large quantities for railway work, much more substantial transmission lines will be required than with present practice.

Mr. F. B. H. Paine, of the Niagara, Lockport & Ontario Power Company, Buffalo, advocated the federation of smaller organizations, and the supply from a single generating station of lighting and railway power over any considerable districts. He spoke of a case where there were in two counties about a dozen separate central stations, aggregating in rating about 500-kw, which were purchased by one interest and supplied with electrical energy from a single source. It is expected that within five years between 4000 and 5000 kilowatts will thus be distributed throughout these two counties.

Mr. R. F. Schuchardt, of Chicago, said that a single decade ago the paper by Mr. Darlington would have seemed visionary, but that it is now in actual accord with conditions being rapidly developed. The centralization of electrical supply, he said, is one of the most important movements in the electrical field. In regard to the electrification of terminals, he said that if in Chicago all the passenger trains were electrically operated for a distance of from twelve to fifteen miles from the center of the city, the maximum load demand would be less than the total output of two units being placed in the Chicago and Northwestern generating plant.

Transmission.

OPERATION OF TRANSMISSION SYSTEMS.

In a written communication to a topical discussion on operating transmission systems Mr. Max Hebgen, Butte, Mont., said that the most important factors in securing uninterrupted service on transmission systems were stated to be insulation, mechanical strength, general design of system and operation. He claimed that the factor of safety in the insulation of transmission systems as now employed is too low. For a 100,000-volt system the safety factor should be not less than three, for 50,000 volts it should be four, and for 20,000 volts it should be five. He stated his belief that for all electromotive forces above 20,000 volts the suspension type of insulator is far preferable to the pin type. When the suspension type is employed no difficulty is encountered in obtaining the factors of safety mentioned above.

Mr. Hebgen claimed that too much attention cannot be paid to the mechanical strength of a transmission line where continuity of service is essential. He stated that any wire larger than No. 6 gage should be stranded; the 6-wire stranded conductor with a hemp center exposes more surface to wind and ice than does a 7-strand conductor of equal conductivity, so that the advantage of having all the wires subjected to the same stress is more than counterbalanced, and the 7-wire strand is altogether preferable. He said that the clamps for suspension insulators should be connected to the insulator by a hinge joint so that there will be little tendency to bend the wire when the insulator pulls in a direction other than perpendicular to the wire.

Transmission lines feeding energy to an important load center should be in duplicate or triplicate. They should preferably follow different routes, but where this is impracticable the different lines should at least be mounted on separate poles spaced far enough apart to prevent the possibility of one line interfering with another. All lines should be sectionalized by means of out-door air-break switches, with a cross-over switching station at the middle of the line equipped with switches so arranged that one-half of either line may be cut out and the remaining section continue in operation. In any case where two or more lines supply energy to the same point, the incoming lines should be controlled by reverse-power relays. Troubles from lightning can be guarded against by high insulation, the installation of one or more overhead grounded wires and the use of electrolytic arresters. Continuity of service depends equally as much on good operators as on good apparatus. In large systems all operations should be controlled by one man who has the position of load dispatcher. The importance of systematic patrolling of the line should not be overlooked.

A written communication was received from Mr. J. P. Jollyman of the Western Power Company, San Francisco, Cal., who claimed that in order to eliminate interruptions to service the power houses should be built on the unit system, only such cross-connections being used as are absolutely necessary for proper flexibility. It is especially essential that all apparatus which may need immediate attention in the event of trouble should be within the reach of every man. Relays should be used sparingly, if at all, because the power-house circuits must not be disarranged by any ordinary disturbances which may come in from the transmission system. The transmission line should preferably be constructed in duplicate on separate poles. In case only one pole line can be erected the arrangements should be such that one circuit may be kept in operation while the other is undergoing repairs. In order that trouble originating on one distributing line may not interfere with other feeders, fuses or relays are necessary on the distribution circuits radiating from substations.

A written communication was also received from Mr. R. S. Kelsch, Montreal, who claimed that the most successful method of obtaining continuity of service from the high-voltage transmission line is to use the same factor of safety on the line as is now employed in the power house with its reserve generators, duplicate busbars, extra exciters, spare transformers, etc. A high factor of safety in the insulation is of the greatest important. Too much economy has been practised in the purchasing of insulators in the past; there are numerous transmission lines in operation to-day that should have a factor of safety in the insulators three times as great as at present.

Mr. W. N. Ryerson of the Great Northern Power Company,

Duluth, Minn., expressed the opinion that too much insulation may prove disadvantageous in low-voltage work. Mr. F. B. H. Paine of the Niagara, Lockport & Ontario Power Company, Buffalo, N. Y., remarked that troubles on transmission lines are frequently hard to locate although easy to correct after being discovered. He mentioned the fact that certain line patrolmen now make use of automobile or bicycle head-lamps in patrolling the line at night.

Mr. B. F. Pearson of the Southern California Edison Company, Los Angeles, Cal., stated that it had been found necessary to subdivide the 118-mile 75,000-volt transmission line in order to continue operation in case of failure to any one part of a circuit. He called attention to a peculiar faulting of pin-type insulators upon which cracks develop on the interior petticoat, attributable probably to excessive temperature. Difficulty has been encountered with the pin type of insulator construction on account of birds standing on the steel cross-arms and stretching their wings to reach the live circuit above. This trouble can be overcome by the use of the suspension type of insulators. In replying to the question of Mr. R. J. McClelland of the Electric Bond & Safe Company of New York, Mr. Pearson stated that the interruptions to the Kern River transmission line totaled 160 in a year, most of which occurred during the spring season when the birds were more inclined to stand upon the transmission lines.

Mr. J. R. McKee called attention to the fact that the limit of increase in voltage to a transmission system is set by the corona loss rather than by the amount of insulation employed. Experience would seem to indicate that at the high altitudes in Colorado, 100,000 volts is about the limit; in Michigan, where a 110,000-volt system is operating without lighting arresters or overhead ground wires, no trouble is experienced from interruptions, probably on account of the excess of corona loss accompanying any abnormal increase in the voltage.

Mr. G. H. Walbridge, of Denver, said that most of the troubles encountered on the system of the Central Colorado Power Company have proved to be mechanical rather than electrical. Considerable trouble has been caused by the excessive wind velocities at the high altitude of 13,500 ft., at which a certain part of the transmission line is erected. Mr. E. L. West, of the Central Colorado Power Company, remarked that, on account of the condenser effect, when an electromotive force of 100,000 volts is applied on the 190-mile transmission system, an electromotive force of 150,000 volts is obtained at the far end. The clearance between wires has proved to be too small for the high altitudes encountered. He said that, by actual measurements made by government officials, the wind velocity has been found to reach 165 miles per hour at the highest point of the transmission line. In order to prevent breakage of the transmission line, due to kinking, use is now being made of a flexible saddle for connecting the insulator to the line.

Mr. West said that the hemp-core, six-wire cable has proved satisfactory during the three years it has been in operation. Mr. Ryerson remarked that hemp-center cable used by the Great Northern Power Company has been found in good condition after five years of service. Mr. R. G. Black, of the Toronto Electric Light Company, stated that the six-wire, hemp-core cable employed between Niagara and Toronto has given no trouble during the five years of service; the only interruptions to the 90-mile 60,000-volt transmission system has been those attributable to lightning. In May there were three interruptions, but in the previous nine months there was none.

Mr. P. H. Thomas, of New York, stated that the enormous currents produced on short circuit could be minimized by the use of series impedance combined with some automatic means of sectionalizing the system. Mr. Pearson remarked that a scheme similar to that described by Mr. Thomas is being used in Southern California. It has been found that the synchronous apparatus is not thrown out of step during short circuits.

Mr. N. J. Neall, Boston, called attention to the conditions of operation in a certain manufacturing plant receiving energy from one stream and three hydroelectric stations. In this system there are no automatic circuit breakers, the operator being depended upon to open switches by hand in case trouble develops.

Mr. D. B. Rushmore, of the General Electric Company, Schenectady, remarked that a transmission system must be designed for both normal and emergency conditions. In order to minimize troubles, it is necessary to employ high-class apparatus, and engineers should learn to distinguish between apparatus of this type, which is costly to produce, and the cheaper grades of apparatus found upon the market.

PROTECTION FROM LIGHTNING.

The committee on protection from lightning, Mr. B. E. Morrow, Hudson River Electric Power Company, Albany, N. Y., chairman, obtained the data for its present report, not by sending out a list of questions to each member company of the association, but by selecting some twenty companies which have considered the effects from lightning disturbances as constituting an important factor in the success of their business, and have therefore gone into the matter very thoroughly. It states that with improvements in the art of insulation and of lightning arresters failure of apparatus from lightning is becoming very much less frequent. The results obtained from the use of the electrolytic type of arrester have been very satisfactory. Arresters of the horn type are in common use, but in a great many cases are being rapidly replaced by those of the electrolytic type. On the other hand, an objection to the electrolytic arrester is its high first cost and the necessity of frequent charging and attention; indeed, in a station of minor importance it has been considered cheaper to replace an occasional damaged transformer. Transmission lines having overhead ground wires appear to have suffered the least damage. The use of a grounded metal ring for each insulator is reported as being effective for the elimination of line disturbances, but is no protection against a direct stroke and is expensive. In some cases a grounded spark gap has been provided for each insulator, and still another form is that of installing a grounded wire on each pole, carrying it well above the top. A special device, known as an arc suppressor, is now being experimented with for the relief of transmission line troubles due to an arc around the insulator, the device being used at the busbars of the principal station to take care of the entire system.

In its recommendations the committee states that where all lines leading into a station are operated separately each of them should be provided with an arrester installed on the line side of all apparatus. In other cases experience justifies installing one arrester on the common busbar. The installation is recommended of choke coils in every circuit leading to the generating station, advantage also being taken of the newer and improved types of insulation for transformers and other classes of apparatus connected with a high-tension system that are especially susceptible to damage from lightning or surges. In the case of stations where no arresters are being used the electrolytic type is recommended; if, however, arresters of the multi-gap or horn type are in use and giving satisfactory service there is no need for a change. The committee unqualifiedly recommends the use of the overhead ground wire, which should be grounded at every supporting structure, either pole or tower. A lightning rod carried above the ground wire is also recommended. The results of investigations have shown that a lightning arrester does not protect any apparatus on a distributing system more than 400 ft. or 500 ft. away. A calculation is given showing that it would not pay to increase the number of arresters beyond one for each $500 worth of transformers. The company repeats its recommendation as to the inspection of arresters, as well as to the importance of detailed records.

DISCUSSION.

Dr. C. P. Steinmetz said that, ten years ago, electric circuits were practically helpless against lightning, whereas at present they can be almost completely protected against all

forms of lightning; the problem of lightning protection has thus become essentially an economic one, as to how far the cost of protective apparatus is balanced by probable damage to apparatus. A protective device should be close to the apparatus to be protected, and it is a question whether we should not abandon altogether the attempt to protect distribution circuits and confine attention to the apparatus connected to these circuits, installing the devices near them. In other words, it is becoming more economical from year to year to connect the arresters to the device to be protected, and not distribute them along the line. Dr. Steinmetz described the manner in which the various troubles relating to lighting disturbances and abnormal voltages may be scientifically determined.

Prof. E. E. F. Creighton recommended, as a means for determining the condition of an aluminum lightning arrester, connecting an ammeter in series with it when it is being charged. The details of the method, however, were not elaborated. The valuable quality of an aluminum arrester is, he said, its capability of discharging heavy currents at abnormal voltages, but it cannot economically be built to discharge the main generator current.

Mr. R. P. Jackson, of Pittsburgh, emphasized the importance of good insulation of apparatus. He did not believe in the indiscriminate use of lightning arresters that discharge freely, when they should be set to a higher voltage and the additional stress taken by the insulation of the apparatus. Some of the money that has been spent in protective apparatus might well be spent in better insulation and on improving the transmission lines.

Mr. H. B. Gear, of Chicago, said that data are lacking on the subject of the proper spacing of arresters. Referring to an economic study of the question, he said that the matter of interruption must be taken into consideration.

Mr. Farley Osgood, of Newark, said that there is a possibility in some cases of which he knows that the number of lightning arresters now in use may be decreased; but that the lightning protection problem is one for individual study, as local conditions may influence the number of arresters to be used. Grounding the secondary will enable a reduction to be made in the number of lightning arresters. In conclusion, Mr. Osgood advocated a careful study of the subject of protection from lightning, rather than increasing the number of lightning arresters.

Mr. Percy H. Thomas, of New York, agreed with Mr. Jackson as to setting lightning arresters at low voltage, as it is a menace every time an arrester discharges, the system being strained each time. A trouble to be expected with the electrolytic lightning arrester is that when the discharge passes over the horn-gap the potential of the line is momentarily reduced, and the apparatus subjected to a severe shock. The electrolytic arrester has the disadvantage over the multi-gap series arrester of discharging frequently. Numerous advantages of the multi-gap type of arrester were pointed out. Mr. Thomas said that the new schemes for shunting out an arcing ground on a transmission line seemed to have made progress. The idea of the type of device referred to is to close a circuit automatically in shunt at the power-house as soon as the arc is established. This takes the potential off that portion of the line, which then is automatically restored.

Mr. Paul M. Lincoln, of Pittsburgh, said that there are several means besides lightning arresters for taking care of lightning disturbances. One is the use of the suspension insulator, which has a grounded portion above the line to be protected; the second is the use of a ground wire above the transmission line, and the third is the grounding of the secondary distribution and primary transmission circuit. These three methods of construction will, he believes, secure a greater reduction in damage from lighting disturbances than the use of arresters.

Prof. Creighton considered some of the comparisons made between the aluminum and multi-gap arrester. The former, he said, was designed specifically to take care of continuous surges for a considerable length of time, which the former cannot possibly do, because of the heavy current that flows and the great amount of voltage expended in the resistance rods. When the neutral is grounded the difficulty is transferred from potential to current troubles. In many cases, however, it is advisable to ground the neutral, especially in the operation of a railway system.

Mr. E. J. Richards, Pittsburgh, said that very good results have been obtained during the past two years from the use of aluminum-cell arresters on high-tension lines and feeders. He directed attention to the inspection and care required in the operation of aluminum-cell arresters. There has been only one interruption due to insulator failure on the lines referred to during the past two years, and this was caused by a direct stroke of lightning.

Mr. Farley Osgood said that he could not agree with the statement that multi-gap arresters require no attention, because dirt will collect on them and cause trouble if not removed.

Mr. H. L. Wills, of Savannah, said that in the case of a 6600-volt system good results had been obtained by connecting one side of the lightning arresters to the line and the other side to the ground wire; the next line is connected to a lightning arrester, but not connected to the same ground wire, etc. By connecting one lightning arrester to one line at one pole, and the next lightning arrester to the other line at another pole, there is a much easier discharge.

Distribution.

GROUNDING AS A PROTECTIVE MEASURE.

In a paper with the title "Grounding of Low-Tension Circuits as a Protective Measure," Mr. Paul M. Lincoln, of the Westinghouse Electric & Manufacturing Company, pointed out how under certain conditions comparatively high-voltage strains may appear between low-tension windings of transformers and ground when these transformers are connected to a relatively high-tension transmission system. The fundamental cause, he stated, why break-downs so often occur on low-tension circuits simultaneously with disturbances on the high-tension side is that transformers act to a very considerable extent as condensers as well as transformers. A method is given whereby, knowing the construction of a transformer, its static capacity as a condenser can be determined with a fair degree of accuracy. It was shown that the greatest danger to the low-tension windings of transformers from disturbances on the high-tension side will take place when the low-tension windings are entirely disconnected from all other circuits. Moreover, any attempt to overcome the difficulty by increasing the insulation of low-tension winding is a step in the wrong direction. Examples are given showing the amount of static potential induced by the high-tension winding upon the low-tension winding of a transformer, which may be as high as 27 per cent of the voltage impressed across the high-tension winding, and in an abnormal case even as high as 115 per cent. A remedy for this condition is to ground the low-tension windings and thereby afford a path by which the condenser current may be taken off. The ground connection should be a sturdy one, not only on account of the fact that quite an appreciable current may be passed by the condenser, consisting of the high-tension winding as one plate and the low-tension as the other, but also to insure that the ground connection is not such a flimsy one that it would be destroyed at the slightest provocation. In conclusion, Mr. Lincoln stated that the reasons set forth make a very good argument for grounding low-tension circuits when obtained from a high-tension system. This is, however, by no means the only argument for the grounding of low-tension circuits, and he suggested that the slogan "Ground your low-tension circuits" would not be a bad one for the N. E. L. A. to adopt.

DISCUSSION.

Replying to a question, Mr. Lincoln said that in general the greater the voltage the higher will be the amount of insulation on the high-tension winding, resulting in reduced static

capacity of high tension against low tension. The actual ratio does not make any large difference in the ratio of the two static potentials which govern this difference of potential upon the secondary winding.

Mr. G. E. Brown, Brooklyn, inquired whether grounding should be practised in the case of two 250-volt, three-wire power services and also whether it is possible to get 700 volts to ground from the secondary of the ordinary commercial pole-line transformer in case a primary 2400-volt circuit is grounded.

Mr. T. W. Varley, New York, asked how much current will flow from a secondary to ground under normal conditions. Mr. Lincoln replied that the worst condition is where the secondary of the transformer is entirely isolated from all of the circuits, in which case with a ground on the high-tension windings one may get on the secondary from 20 per cent to 30 per cent of the terminal voltage of the high-tension circuit. The amount of current which can be passed under ordinary conditions is very small. As the frequency goes up the current goes up in the same ratio, but extreme conditions obtain only when the static discharge, the direct ground or the lightning charge is present. The worst conditions arise from the isolation of the secondaries.

WIRING AND EQUIPMENT STANDARDS.

The report of the committee on improved wiring and equipment standards, Mr. M. C. Rypinski, of the Westinghouse Electric & Manufacturing Company, chairman, gives a résumé of answers to eight questions on a form sent out to member companies. In reply to a question as to whether the company has a system for aiding a customer financially in wiring his home, 80 of 160 central stations replied that they had no such system; all the others have some method of taking care of the consumer, the most common being to charge the wiring to the customer at cost, or cost plus a small profit, allowing him to pay the charge by monthly instalments varying anywhere from two to three months up to twenty-four. A number of replies are quoted which give details of the practice of some of the companies.

Of 160 central stations, 125 replied that they had no system for laying out the wiring of houses. A few replies are quoted in which such a system is in use. In reply to an inquiry as to whether there is a system of co-operation with contractors, forty-eight negative replies were received, and several replies are printed giving information as to methods of co-operation. In reply to an inquiry as to a campaign of education among architects, 105 negative replies were received, and several were quoted from those who co-operated with architects.

As to the extent to which present costs retard the wiring of houses, fifty-five central stations disclaimed any knowledge along that line, forty-two stated that wiring was not retarded at all by present costs, and sixty-three felt that present costs had retarded wiring, particularly of old houses—the majority of these believing that this consideration affected about 50 per cent of prospective business. The general opinion was that the cost of wiring new houses did not need as much reduction as the cost of wiring old houses.

In conclusion, the committee stated that it had been asked to assist in the compilation of a handbook on wiring, to be issued jointly by the National Electric Contractors' Association, the National Electric Lamp Association and the Commercial Section of the National Electric Light Association. It is intended that the handbook shall be placed in the hands of the central-station solicitor, contractor and, where necessary, the consumer. It will contain, among other things, model plans for the various classes of houses, with illustrations of proper wiring outlets, and including details as to equipment varying from the most simple to the most complete. The handbook will be sold to company members of the association at a price very little in excess, if any, of its actual cost.

No discussion followed the presentation of this report.

UNDERGROUND CONSTRUCTION.

The report of the committee on underground construction, Mr. W. L. Abbott, chief operating engineer Commonwealth Edison Company, Chicago, chairman, gives the results of investigations undertaken by the committee bearing on conduit construction, cables and their installation, auxiliary subway equipment and operation. It is pointed out that the cost to the larger companies of subsurface structures amounts to about one-fourth of their entire investment. The committee stated that the use of fiber duct is increasing, the reasons given being that it does not injure the cable sheath, offers little resistance to pulling in and out of a duct, and protects the cable sheaths from electrolysis. Complete instructions are given for making joints in lead-covered cables, the details being taken from the specifications used by four different companies which had independently adopted almost identical specifications for such joints.

Although it proved impossible to ascertain definitely the influence of the duct material as affecting electrolytic action, two companies stated their preference for fiber conduits over any other material for ducts. Some of the companies attempt to keep the cables practically insulated from the ground, except at the station ends. However, in all cases where the electric-lighting companies are in any way allied to the electric-railway interests the sheaths of the electric-lighting cables are frequently connected to the rails and to the negative return circuits in the proximity of railway stations.

Among the auxiliary devices for a subway system, manhole transformers, junction boxes and disconnective switches were briefly discussed. Descriptions were given of the Marz system of cable protection and the Torchio-Varley selector ground-detector system. The former depends upon the effect of the unbalanced currents in the series transformers at the two ends of the system when current passes to earth at some point between the ends. The latter system depends upon the unbalance in the electrostatic conditions when one conductor of a three-phase system is brought to earth potential by a ground along the line.

DISCUSSION.

In reply to a question by Mr. Farley Osgood, Newark, N. J., as to the use of concrete conduit such as is employed in St. Louis, Mr. S. B. Way, of the Union Electric Light & Power Company, St. Louis, Mo., stated that this conduit was installed under adverse conditions in Joliet, where it did not prove successful, but its use is being extended in St. Louis with very satisfactory results. The cost of this construction is about equal to that of a single duct surrounded by a 3-in. wall of concrete. The conduit possesses the advantages of being absolutely fireproof and of uniform quality. It is disadvantageous in that its installation requires good warm weather. Where concrete conduits have been substituted for Edison tubes that have rotted away and required replacing they have proved quite satisfactory.

Mr. F. B. H. Paine, Buffalo, called attention to the fact that in semi-rural communities in a large part of Germany the practice is to lay cables directly in the earth alongside of the road and to do away completely with ducts. The cost is found to be approximately 50 per cent greater than that of overhead line construction. Mr. Philip Torchio, New York Edison Company, said that well-insulated lead-covered conductor, wrapped with jute and armored with steel, should last indefinitely, provided it is not necessary to alter its location after being placed in the ground. The armored cable construction has proved advantageous in certain sections of New York City, notably Central Park. This type of construction seems well suited for sparsely settled districts, though not applicable in congested city streets. In reply to a question by Mr. W. K. Vanderpoel, Newark, Mr. W. C. L. Elgin, of the Philadelphia Electric Company, Philadelphia, Pa., stated that there is only one effective method to rid a manhole of gas, and that is to place a false cover over the manhole and force the gas back into the pipe from which it has escaped.

GROUNDING SECONDARIES.

The report of the committee on grounding secondaries, Mr. William H. Blood, Jr., Stone & Webster, Boston, chairman, reiterates its position that it would be unwise to carry the grounding of secondary circuits above 150 volts. It admits, however, that such good authority as a committee of the American Institute of Electrical Engineers wishes to carry the limit to 250 volts. While it may be safe to ground between 150 volts and 250 volts, the N. E. L. A. committee does not, however, feel warranted in suggesting that a rule be made mandatory covering these potentials. On the contrary, it believes that a voltage of 150 volts to ground is about as high as it would be safe to handle at all times, and if this were raised to 250 volts accidents and fatalities are likely to occur.

The committee believes it much more necessary to protect the lighting than the motor circuits, owing to the large proportion of lighting customers and to the large number of people who handle electric lights who, unlike those who handle motors, are not expert in electrical matters, and because the lighting circuits are less carefully installed than motor circuits, and often so located as to render the getting of a shock an easy matter. Referring to means of grounding, it is stated that metallic piping systems give the best grounds, and that plates and other devices are at best makeshifts. Regret is expressed that certain grounding devices are now on the market which in fact do not make good ground connections. The report quotes the resolution adopted at the annual meeting this year of the Underwriters which, after stating that there is difference of opinion as to whether the grounding of circuits having a normal difference of potential of under 150 volts induces hazards due to such grounding, urges that municipal departments shall make the grounding of secondary circuits up to 150 volts mandatory; that underwriters' inspection departments recommend at all times such grounding as a proper and desirable precaution which induces no fire hazard; that the National Electric Light Association be urged to see that all of its member companies be brought to realize the necessity of such grounding for the protection of their customers, and that the American Institute of Electrical Engineers be urged to use its best endeavors to harmonize the present difference of opinion as to the limit of voltage at which grounding ceases to be desirable, by determining the limit which shall meet with general approval.

In conclusion the committee, in view of the above resolutions, urges upon every member company the desirability of taking steps to see that its circuits up to and including 150 volts be effectively and permanently grounded.

DISCUSSION.

Mr. Farley Osgood, Newark, said that he was in accord with Mr. Blood's report, but he felt that grounding should be done up to 250 volts. He recommended that all operating men should give special attention to the subject, giving their ideas as to the proper voltage limit. Mr. Osgood said that the underwriters will not at present make grounding the secondary mandatory. It reduces the life hazard, but does not usually decrease the fire hazard to a sufficient extent to justify raising the fire rate in cases where secondaries are not grounded. The speaker advocated testing 200 or 300 grounds at intervals of six months, or a year, preferably making the second test under different weather conditions from the first. He said in conclusion that the committee would be greatly helped if every operating company would send to it a report of a number of ground tests.

Mr. H. L. Wallau, Cleveland, said that in operating a Y-connected system with a grounded neutral two 2½-in. pipes driven 20 ft. into the ground were installed at one station. Direct-current tests showed that the resistance of the two pipes were substantially the same, showing a desirable uniformity in the ground conditions. In some cases complaints have been received from customers on whose premises circuits from 115-volt potential have been grounded. In one case the company was requested to remove the ground where the maximum ground through a combination of transformers was 220 volts, and this was changed to a maximum of 115 volts. Mr. Holdrege mentioned a new form of ground plates consisting of a series of disks of molded cement which are placed at the proper wire. The cement is impregnated with a metallic salt, the outfit being cheap and easily installed. Mr. Osgood said that his practice is to use a series-pipe ground where water systems are not available. He considered this superior to any cone type of ground. Mr. Hertz said that his experience was that the ground resistance of the cone type of apparatus was too high, the trouble being probably with the size of the cone. He favored the grounding of 150-volt circuits with the object of making no point of greater potential after a circuit is grounded.

Mr. P. T. Davies, Montreal, stated that 250 tests on ground pipes showed that 90 per cent were short-circuited when 110 volts were applied across the conductor to ground. Cones showed a better ground than ordinary pipe, and he did not consider pipes satisfactory when set in rocky soil. Mr. Blood said that most of the grounding devices on the market do not give sufficient contact with the earth. The character of the soil is probably the controlling feature in a good ground. In seaport towns, like Boston and New Orleans, a good ground may be made by driving a pipe of small size into old dark mud, but in rocky areas like Arizona many pipes would have to be driven to considerable depths to get a reliable ground. Ordinary soil seems to vary in different lays, requiring driving to depths from 5 ft. to 20 ft., according to local conditions. The grounding section is also affected by the season of the year.

Mr. Paul M. Lincoln, Pittsburgh, said he was favorably impressed with the scheme of a ground made by driving a pipe into the earth and pouring concentrated brine in and around it. The fundamental point is the area of conductor in contact with the earth. Mr. H. W. Stevens, Boston, said that the practice of his company is to employ a 350,000-circ. mil cable about 5 ft. long, spinning it out to a depth of about 5 ft. or 6 ft. and filling the hole with rock salt. The connection to the cable and transformers is made with a No. 0000 wire. Mr. Holdrege found that the use of brine destroyed the ground pipe at the end of a year.

Mr. Mowbray favored not exceeding 150 volts in grounding secondaries, contending that the effects of a 250-volt shock are extremely unpleasant, not to say dangerous. Mr. Paul Spencer, Philadelphia, agreed with the foregoing speaker, citing two fatal accidents from 250-volt circuits in one of the companies with which he is connected. He felt that Mr. Blood in his recommendation limiting grounds to 150 volts had taken a correct and conservative stand.

METER REPORT.

The meter committee, Mr. George A. Sawin, Public Service Electric Company, Newark, N. J., chairman, submits its report with the title "Necessity for Maintained Accuracy." A table is given showing a great improvement in accuracy between the years 902 and 1910. During this period the light-load accuracy has increased from 84.4 per cent to 95.9 per cent and the heavy-load accuracy from 92 per cent to 98.4 per cent. Another table gives the percentage of accuracy of several types of meters as follows: Induction meters, heavy load, 97 per cent; light load, 92 per cent; commutating meters, 110-200 volts, direct current, heavy load, 92 per cent; light load, 74.5 per cent; commutating 500-volt meters, direct current, heavy load, 78.5 per cent; light load, 63.5 per cent. A considerable section of the report is devoted to descriptions, with illustrations, of new meters recently placed on the market. A section is devoted to meter testing and to meter-testing tools and appliances, with illustrations. The practice in reading meters is given for the Union Electric Light & Power Company, St. Louis, and for the United Electric Light & Power Company, of New York City. The section on records of costs details the cost data which each meter department should keep, and suggestions as to the methods of keeping these costs are given. Several pages are de-

voted to flat rates, in which reports are given from a number of towns and cities which, in part, have adopted flat-rate systems. A digest is given of laws having a bearing on the electric-meter department which during the last year have been passed in New York, Wisconsin, North Carolina, New Jersey, Maryland and South Carolina. Half of the report of seventy-two pages is taken up by a continuation of the meter code, the present portion (Section IX) dealing with maintenance methods. This is an elaborate treatise on the subject of maintenance, including an analysis of all the various causes of inaccuracy, with instructions for their correction. Many illustrations are included and also an excellent index.

DISCUSSION.

Mr. H. H. Lyon, Buffalo, inquired what the practice of the committee was with respect to ball-bearing meters, and Mr. Sawin stated that the recommendation is the same for both pivot bearings or ball bearings. Mr. A. Hertz, New York, stated that the New York Edison Company had concluded not to oil bearings of meters. Trouble had been experienced from caking. In reply to a question Mr. Sawin said that the Public Service Corporation of New Jersey had also encountered caking. Careful speculation and testing of the oil are highly desirable. Mr. S. G. Rhodes, New York, called attention to the thorough investigations of oil made by meter manufacturers, and advised consulting with them to secure the addresses of concerns manufacturing reliable lubricants.

Mr. M. J. Mowbray, Providence, stated that the Narragansett Electric Lighting Company uses a meter with a heavy moving element, with two drags on the same side of the disk. All meters are equipped with the cup diamond jewels. Trouble has been experienced from the running off of the pivot with resultant cutting into the brass, producing a metallic dust in the bearing which nearly stops the meter. The company is now using a form of bearing with the cup diamond jewels removed and fitted with sapphire ring stones. This has greatly improved the situation. Mr. A. G. Strickrott, Schenectady Illuminating Company, said that his greatest item of expense in meter maintenance is with the sapphire jewel. Mr. H. A. Holdrege, Omaha, asked for a definite recommendation as to the frequency with which meter tests would be advantageous. He finds 95 per cent of his single-phase induction type meters accurate within 2 per cent when tested once a year, but felt that other types of meter should be tested more frequently. Mr. Mowbray called attention to the fact that on high speed, where the pivot goes into the brass, it is restrained by the sapphire. He further stated that a deeper cut diamond would aid the drag on the ordinary meter. Mr. Rhodes felt that further tests should be made before adopting a recommendation to change from the cup-diamond type of bearing to the sapphire type.

Mr. Sawin said that some of the large companies make a practice in direct-current meters of removing every jewel for periodical tests, invariably repolishing the jewels. Other companies have had difficulty in re-cupping sapphires. It was his opinion that re-polishing pays. The desirable frequency of tests has been covered in the Meter Code.

OVERHEAD LINE CONSTRUCTION.

The report of the committee on overhead line construction, Mr. Farley Osgood, of the Public Service Electric Company, comprises in printed form 195 pages, divided into four sections as follows: Specifications covering methods of overhead line construction for 2300-volt distribution and for street-lighting circuits, with specifications for material; specifications covering methods of overhead line construction for secondary voltages, including pole wiring for street-lighting circuits inter-company agreement forms and specifications for the joint use of poles by lighting and telephone companies, and specifications for overhead crossings of electric-light and power lines. The last-mentioned is a joint report of the National Electric Light committee, A. I. E. E. high-tension transmission committee, committee on power distribution of the American Electric Railway Association, committee on high-tension wire crossings of the Association of Railway Telegraph Superintendents, committee on electricity of the American Railway Engineering & Maintentance of Way Association. The specifications have been formally aprpoved by the Postal Telegraph Cable Company, Western Union Telegraph Company, American Telephone & Telegraph Company and the New York, New Haven & Hartford Railroad Company. The publication is well illustrated and constitutes a complete engineering handbook of the subject which it covers.

DISCUSSION.

Discussion on the report was opened by Mr. Ernest H. Davis, of the Lycoming Edison Company, of Williamsport, Pa., who expressed his opposition to the section of the report relating to clearance, which he stated in effect condemns all existing types of crossings that are not in accord with the standard adopted. He objected specifically to the specified clearance of 30 ft. above the track, claiming that such a distance is not absolutely necessary for safety, and if specified as a minimum distance it will undoubtedly be held to in the future. The specifications call for extra construction at railroad crossings. Mr. Davis claimed that lives of citizens walking along the streets of a city are equally as important as the lives of the railroad passengers, and if a certain construction is required for railroad crossings an equally good construction should be required along the city streets.

Mr. Benjamin F. Pearson, of the Southern California Edison Company, Los Angeles, Cal., remarked that although the specifications proposed are not acceptable in detail to all engineers they are applicable to conditions of the Southern California Edison Company, which operates over territories covering eight big counties, with line voltages ranging up to 100,000 volts. He expressed his belief that the report should be adopted as a whole.

Mr. W. K. Vanderpoel, of the Public Service Corporation, Newark, N. J., expressed his pleasure at the excellent standardization of rulings relating to poles and cross-arms. Mr. A. S. Miller, of the Union Electric Light & Power Company, St. Louis, expressed the opinion that in view of the predominating importance of the report its adoption should not be considered until after the members have had sufficient time to study it in detail. In reply to Mr. Miller, Chairman Eglin stated that the matter relating to the specifications has been before the association for three years and that all of the member companies have been in actual correspondence with the committee during the entire past year. Mr. Pearson added that the adoption of the report by the convention would not necessarily carry with it a mandatory obligation to carry out the regulations. To this Mr. Miller replied that in case of a damage suit the specifications would be looked upon as a standard of good construction, and any damage caused by a construction not in accord with the specifications would place the company at a disadvantage. He held that, while the report is not a legal document, it represents a very important precedent and should be carefully considered before it is passed.

Prof. A. S. Richey, of the Worcester Polytechnic Institute, Worcester, Mass., as representative of the power distribution Committee of the American Electric Railway Engineering Association, requested that the specifications for the joint use of poles be not passed by the National Electric Light Association until an opportunity has been afforded for consultation with the proper committees of the American Electric Railway Association. He stated that there were several matters in this section which were not in accord with the standard of electric railway practice and were unjust to electric railway interests. He stated that the objections raised by the railway people related more largely to telephone circuits than to electric circuits, and the Railway Association does not wish the National Electric Light Association to adopt a specification which would prove a great leverage with the telephone interest.

Mr. George H. Lukes, of the North Shore Electric Company, Chicago, Ill., suggested that the report be accepted as one of progress. President W. W. Freeman stated that it is necessary for the association to adopt a standard on important

questions. He suggested that in the event of disagreement concerning the adoption of the report the entire matter be referred by both sides to the executive committee of the association. The executive committee will then put itself into communication with any who wish to communicate their wishes and will try to reach the correct conclusion on the subject.

Mr. George E. Wendle, of the Lycoming Electric Company, Williamsport, Pa., claimed that a clearance of 24 in. between circuits occupying joint poles is known to be safe, and thought it unnecessary to specify 48 in. as the minimum clearance. Mr. Arthur S. Ives, of the Central Hudson Gas & Electric Company, Poughkeepsie, called attention to the fact that the spacing between pins on an eight-pin cross-arm is less than on a four-pin cross-arm, and remarked that any spacing which is safe for the former should be equally safe for the latter. He stated that between wires on a joint pole the clearance could well be at least 6 ft. so as to prevent the men standing on the cross-arms in order to work on the transmission wires.

Mr. Paul Spencer, of the United Gas Improvement Company, Philadelphia, expressed the opinion that the entire report could safely be adopted; but if the members could not agree upon the absolute adoption of the report, such action should be taken as would lead to the adoption of the report after such conference as may be necessary to get the full consent of other bodies interested. Capt. William Brophy, of the Boston Edison Company, expressed the belief that the report can be adopted without prejudice to any company in case of a lawsuit. A universal practice is recognized to be as binding as law, and the specifications seek only to harmonize the general practice. He commended the work of the committee, stating that the report itself is a fitting monument to it and suggested that the members dedicate it by adopting it.

Upon motion by Mr. Louis A. Ferguson, of the Commonwealth Edison Company, Chicago, which was carried, the technical session recommended to the executive committee the adoption of the report as a whole.

PRESERVATIVE TREATMENT OF POLES AND CROSS ARMS.

The report of the committee on the preservative treatment of poles and cross-arms of last year treated the subject more or less generally, while the present report takes up the subject in specific detail. Mr. W. K. Vanderpoel, of the Public Service Electric Company, Newark, was chairman of the committee, with Mr. C. C. Tutwiler, chairman of a sub-committee on preservatives, and Mr. Martin Schreiber, chairman of a sub-committee on treatments. The section on preservatives is confined to a report on creosote oils and the methods for the introduction of such oils into timber. The committee recommends, as the result of its investigations, that this class of preservative be used for the treatment of line poles. Three specifications for creosote are included in the report. The various processes are considered under the heads of brush and dipping, open tank and pressure treatments. The report, which comprises 122 pages, includes numerous illustrations relating to processes, etc. There is a number of appendices, dealing with the following principal subjects: European method of treating telephone and telegraph poles, by Dr. Herman von Schrenk; the open-tank treatment of poles with creosote, by Mr. Howard F. Weiss; report of an operating company giving its experience with a creosoting plant; damage to poles by wood-boring insects; U. S. statistics of poles sold during the years 1907-09; discussion of the 1910 report of the committee, by Dr. Herman von Schrenk.

DISCUSSION.

The discussion of this report was opened by Mr. R. V. Coombs, of the Public Service Electric Corporation, Newark, who asked a number of questions relating to the size of flasks, method of taking samples of impregnating material, the size of auger to be employed in boring holes in the pole and the permissible size of knots in cross-arms. He claimed that a cross-arm containing a large knot should not be accepted for line construction.

Mr. F. D. H. Paine, of the Niagara, Lockport & Ontario Power Company, Buffalo, remarked that the principal element in the cost of transmission, aside from the interest on the investment, is the maintenance of the lines, which means the avoidance of trouble whenever it occurs. If preservatives can be used in poles in order to increase the length of life, the maintenance will be correspondingly reduced, and troubles resulting from the necessity of replacing structures will similarly be reduced. He expressed the opinion that steel has been adopted for transmission towers almost wholly on account of the permanence obtained. As a matter of fact, there are many features of a wooden pole line which render it preferable to a steel pole line. The only real disadvantage of the wooden pole is its short life, hence the importance of preservative treatments to transmission companies can easily be appreciated.

H. A. Holdredge, of the Omaha Electric Light & Power Company, Omaha, stated that of several thousand southern pine poles treated with concrete by the pressure process, which have been in the ground for five years, not one shows evidence of decay at the present time. However, the conductivity of the poles is a disadvantageous feature. The creosoted pole acts at all times as does an untreated pole after a long soaking rain. The wires held by these poles can be handled by men only when they use rubber gloves.

W. L. Abbott, of the Commonwealth Edison Company, Chicago, expressed the opinion that it would be feasible to treat a pole already erected in the ground with creosote by inclosing that section of the pole in some kind of a cylinder which could be rendered watertight, pressure then being put upon it at that point.

B. F. Pearson, Los Angeles, stated that the Department of Forestry of the United States has co-operated with the transmission companies in southern California in the erection of a plant in which about 400 poles have been treated and planted in all kinds of soils and examined every year. The open hot tank treatment with subsequent cold immersion afterwards has been found the best. The companies have adopted the policy of treating all poles thoroughly before putting them into the ground for any purpose, whether for transmission or distribution.

Dr. G. Alleman stated that he knew of no business which is as productive of frauds as the creosoting business. He claimed that it is absolutely necessary to have conscientious and rigid inspection in case the creosoted material is to possess the characteritics intended. In certain cases where the specifications called for an impregnation of 12 lb. per cubic foot tests have shown that the actual impregnation did not exceed 8 lb. In a certain case where poles were ordered for the U. S. Army according to a specification calling for 20 lb. of creosote per cubic foot about 9 lb. was found to be the maximum and 3 lb. the minimum in the poles delivered.

Lamps and Illumination.

ILLUMINATION FOR INDUSTRIAL PLANTS.

The report of the committee on industrial lighting, Mr. M. S. Sloan, Birmingham (Ala.) Light & Power Company, chairman, consists of a number of monographs, including descriptions of actual lighting installations or plans for the same. The first paper is by Mr. D'A. Ryan, of the General Electric Company, which, under the title of "Industrial Lighting," lays down the fundamental principles applying. The conclusions are as follows: 1. Large units for high-studded rooms, small units for low-studded rooms. 2. Lamps should be above the cranes and always as high as conditions permit, using in every case suitable reflectors. 3. The largest lamps should be selected consistent with sufficiently good disposition for the particular purpose. 4. Where the floor space is large and the work rough there should be a moderate general illumination with local lights at the tools. General illumination should be used where there is a great number of small machines in a relatively small space. For presses or machines turning

out particularly fine work individual lights will probably be required. 5. Employees should be protected as much as possible from direct rays of light, the intrinsic brilliancy being cut down and good diffusion secured. 6. Local lights should range from 2 cp to 8 cp and be completely covered by reflectors so ventilated that stray light cannot enter the eyes of the operators from the top and with the light field being free from streaks or spots. In the two following papers Mr. Ryan describes, with many illustrations, the illumination of a clothing factory and the illumination of a building of the General Electric Company at Schenectady.

Mr. C. E. Clewell, of the Westinghouse Electric & Manufacturing Company, contributes to the report a paper prepared by the illuminating engineering department of the Westinghouse company describing, with many illustrations, the manner of installing over 7000 tungsten-filament lamps for lighting about 10 acres of floor space in the Westinghouse plant at East Pittsburgh. The considerations are given which led to the disposition chosen for each class of lighting. At 25 cycles no flicker was detected in the 250-watt lamps, and this was scarcely appreciable in the 100-watt and 60-watt lamps. Slight flicker was noticed in 40-watt lamps, but not sufficient to impair the illumination for ordinary purposes. The maintenance cost of the tungsten system described on a percentage basis was found to be 75 per cent for renewals, 3 per cent for broken reflectors, 16 per cent for making renewals and changing reflectors for washing, 2 per cent for washing reflectors, and 4 per cent for additional indirect charges, the total being 100 per cent. It has been found that one man can inspect 3000 tungsten-filament lamps in about two hours' time. Experience showed that if reflectors are not cleaned at fairly short intervals they may lose as high as 40 per cent of their reflecting efficiency. This report forms an excellent contribution to the planning and maintenance of a large industrial illuminating system employing tungsten lamps.

Mr. H. J. Tait, of the Holophane Company, contributed a paper on reflector maintenance, giving practical instructions. Mr. J. S. Codman contributed a communication from the National Electric Lamp Association entitled "Industrial-Plant Lighting," which lays down the fundamental principles concerned and includes a number of illustrations of lighting in factories and shops.

DISCUSSION.

Following the presentation of the above report there was a rather extended discussion bearing chiefly on the installations described in the report rather than on the committee's suggestions themselves. Mr. Sidney Ashe, of Harrison, N. J., asked a number of questions, some of which were answered by Mr. Clewell, one of whose articles was embodied in the report.

Mr. Norman Macbeth, of Bloomfield, N. J., spoke at some length on the cash value of good illumination and suggested that central station managers view the problem of industrial lighting in the light of the larger returns which such business affords. Too often the large returns obtainable from the lighting of industrial establishments is not appreciated as fully as it might be. Speaking of actual installations, he said that for factories having low ceilings the maximum unit was a 100-watt lamp, while a 60-watt lamp probably would give the best service. He was very much pleased that the committee had not attempted to standardize lighting installations.

Mr. M. O. Dell Plain, of Syracuse, N. Y., stated that in installations fed from his company's services with 25-cycle energy the flicker was very noticeable if reflectors having radial corrugations were employed with tungsten lamps. Where smooth surface reflectors are used this flicker is not noticeable.

Mr. C. E. Clewell, of Pittsburgh, Pa., commenting on the foregoing statement, said that the phenomon might be due to light surfaces such as would be offered by a sheet of white paper on a desk. In factory installations where the lamps are located near belts Mr. Clewell stated that a satin-finished reflector shows more rapid deterioration than the plain-glass reflector.

Mr. H. L. Parker, of Baltimore, Md., voiced the need of having specially trained men for soliciting industrial work.

Messrs. F. J. Leitner, of Brooklyn, N. Y.; S. E. Doane, of Cleveland, Ohio; W. D'A. Ryan, of Schenectady, N. Y., and F. N. Willcox, of Harrison, N. J., also took part in the discussion.

COMPETITIVE ILLUMINANTS.

The report of the committee on competitive illuminants, Mr. H. J. Gille, of the Minneapolis General Electric Company, forms a valuable contribution to the subject, owing to the data contained as to candle-power and operating costs of gas lighting units and gasoline installations. The nature of the report does not, however, admit of satisfactory full abstract. It is stated that 85 per cent of the gas used for illumination is consumed in open-flame burners, and that the cost for such illumination is double that of the electric light from either tungsten, Nernst or Cooper Hewitt lamps. About 55,000,000 gas mantles are manufactured annually in this country, as compared with approximately 100,000,000 incandescent electric lamps. Comparing the heating effect of gas and electric lamps, it is stated that an inverted mantle gas burner gives off approximately 2250 lb.-Fahr. thermal units per hour, whereas a 60-watt tungsten lamp, which has a higher illumination value than has the inverted burner, gives off only about 200 thermal units in the same period. Referring to the color of incandescent lamp mantles, it is stated that those which give off a light of good quality have a low efficiency and short life. For this reason the "white light" mantle is very rarely used and the new amber light has a lower efficiency than the ordinary gas mantle. Not more than 60 per cent to 70 per cent of the initial laboratory rating of the gas-mantle lamp can be obtained under good service conditions.

A table is given of the comparative operating costs of gas and tungsten units, gas being assumed at $1 per 1000 cu. ft. and electricity at 10 cents per kw-hour, and in every instance the cost of the electric units is shown to be less. For example, the cost for the Welsbach, Jr., for 1000 hours is $5.50, as compared with $3.91 for the tungsten; for the standard Welsbach, $9.36, as compared with $6.19 for the tungsten; $6 for the open-flame gas, as compared with $2.77 for the tungsten, and $21.17 for the two-mantle "upright gas arc," as compared with $12.38 for the tungsten.

The final portion of the report is devoted to gasoline lighting, the several systems in use being described. The results of tests are given which show that with gasoline at 18 cents per gallon the fuel cost to operate single-mantle units will vary from ½ cent to 1 cent per hour, while with electrical energy at 10 cents per kw-hour a 100-watt tungsten can be operated at an expenditure for energy of 1 cent per hour. If to the energy cost the maintenance expense and fixed charges for the gasoline outfit are added, it will be found that the total operating cost for tungsten lighting is much less than that for gasoline; and that in any event the saving in favor of gasoline will never compensate for its many disadvantages and inconveniences.

DISCUSSION.

Mr. S. W. Ashe, Harrison, N. J., commended the report of the committee, but regretted that data were not given on mercury vapor lamps. He thought that the average c.p. of a lamp during its life should be used as a basis of all engineering service comparisons. Increased life has been obtained by the use of the wiredrawn filament, but at the sacrifice of candle-power to a slight extent. Recent tests on a mercury vapor tube showed that a direct-current equipment maintained 61 per cent of its initial candle-power during its life, an average candle-power of 75 per cent being obtained in an alternating-current lamp of the same type. Inverted and upright gas arcs with pilot flames are more expensive to operate than tungsten lamps. He gave various figures showing the gas consumption of illuminants under service conditions, and said that an average performance of from 60 to 70 per cent of the initial candle-power rating appears conservative. In general, a three-mantle upright gas-arc can be comfortably replaced by a 150-watt tungsten lamp.

Mr. Norman Macbeth, Philadelphia, severely criticised the report on the ground that it was unfair to the gas interests. He contended that electricity could not compete with gasoline lighting on the ground of first cost, and also argued that inverted burners can be successfully operated on pressures as high as 2 in. The main consideration in dealing with prospective lighting installation is what the actual requirements are, and he felt that electricity had been given more weight as a general solvent of lighting problems than was warranted by the circumstances.

Mr. L. H. Scherck, Newburgh, N. Y., contended that the report would not stand the criticism of competent gas men. Mr. E. L. Callahan, Chicago, commended the report with a hearty indorsement, saying that it is the best compilation of data which he has ever seen, being a combination of laboratory and field results of the highest practical value. Mr. George S. Barrows, Philadelphia, supported Mr. Macbeth and Mr. Scherck. Mr. George A. Sawin, Newark, made a vigorous speech in behalf of the report, stating that the figures represent average service conditions and not those of a secluded laboratory. A motion to refer the report to a committee before sending it broadcast over the country was lost.

Mr. Gille closed the discussion by pointing out the fact that the values given in the report are precisely those that will be found under the stress and strain of service conditions. The committee's single object was to assemble approximate data which would be of practical service in central-station commercial departments. The figures have been checked from the operating field. Mr. Gille said that in view of the opposition by the gas interests to the report the committees would be continued during the forthcoming year.

ORNAMENTAL STREET LIGHTING.

Mr. William Rawson Collier, Georgia Railway & Electric Company, as chairman of the committee on ornamental street lighting, submitted a report discussing briefly the advantages and disadvantages of the different systems in common use, including the arc-lamp system, the festoon system and the post system using tungsten lamps. The arc-lamp system is expensive, but probably within a few years such systems will be installed in a number of cities, especially as the flame-arc lamp has been much improved recently. The festoon system, although attractive at night, has the appearance of being temporary and detracts from the beauty of the street during the day. Moreover, the equipment begins to rust within a few years and becomes dangerous unless overhauled frequently at considerable cost. The ornamental-post system is by far the most popular at present. Its advantages are permanence, beauty by day and night, even distribution of light, comparatively low installation and maintenance cost and great advertising value.

DISCUSSION.

Mr. V. R. Lansingh, of New York, commenting on the statement of the committee that, whether the lamps are placed upright, or hang pendant, is not of great importance since the light of tungsten lamps burned in either position is now about the same, said that there is a large difference between the illumination on the street with the one and with the other. Tests made with lamps placed in similar glassware and at the same height from the street surface showed a difference of 35 per cent in useful flux on the street with the lamp pendant as compared with the lamp in the upright position. He maintained that the success of ornamental street lighting schemes will depend on their economy of operation and in this connection pointed to the vast discrepancy between the different systems. Mr. Lansingh gave data on various shaped reflectors and shades indicating that it is necessary to bestow as much study in the question of ornamental street lighting as in the question of arc lighting.

Mr. T. I. Jones, of Brooklyn, N. Y., said the point at issue in ornamental street lighting glassware is the beauty which the globe gives and its advertising value. If flux of light were all that were wanted it would be an easy matter to put a reflector on a lamp to obtain this result. However, merchants wish their places advertised and desire to have the beauty of the system commented on; and where the ornamental post is for the use of the customer and where he pays for it, the type best adapted is that which shows a ball of fire rather than a point of light; so that considered from this viewpoint, the question of flux of light or reflector is of no significance.

Mr. C. N. Duffy, of Milwaukee, Wis., also was of the opinion that commercial men are not particularly interested in the technical side of the question, but rather in the value of the system as ornamentation, and electric advertising. Where the distribution question is allowed to interfere there is no uniformity, one section of the city having posts with the lamps pendant and another section having posts with the lamps arranged vertically. In Milwauke his company installs ornamental posts on a flat rate, including the installation of the posts, at $9 a month on a two-year contract. The cost on a front-foot basis approximates 25 cents. Where the consumer buys the post a flat rate of $6.30 a month is charged, with the lamp burning from dusk until midnight. He called attention to the difficulties often experienced in collecting money from individual consumers and stated that in the city of Racine an arrangement has been effected with the municipality by which the cost becomes a tax against the property.

Mr. W. H. Gardner, of Lincoln, Neb., felt that central stations in this matter have let their aesthetic enthusiasm befog their sense of business. Looked at from the viewpoint of net earnings per foot of street, ornamental street lighting does not begin to yield the returns obtained from window, sign and outline lighting. He said that excessive street lighting hurts window displays and that more emphasis should be placed on sign, outline and window lighting, since these were of more benefit to the merchant; gave more revenue to the central station and also illuminated the street.

Mr. S. M. Kennedy, Los Angeles, Cal., stated that his company had not been required to do any soliciting for ornamental street lighting in Los Angeles or in adjacent cities. This business came to it so fast that in many cases it was necessary to discourage it. His company has found that the miles of ornamental street lighting in Los Angeles are very artistic and very much admired for their decorative appearance not only in the daytime but also at night. This has brought about a highly desirable condition in the artistic education it has given the community. A municipal league in the city will not permit the passage of a sign ordinance since projecting signs would spoil the decorative effect of the posts. The decorative lighting therefore has not only restricted sign lighting but also outdoor and window lighting. Despite the knowledge that the decorative lighting deprives the company of considerable revenue, Mr. Kennedy said he is proud of the decorative effect and of the appearance of the Los Angeles streets.

Mr. A. S. Ives, of Poughhkeepsie, N. Y., urged companies to induce the municipality to pay for the decorative street lighting since every taxpayer is interested in anything that advertises and benefits the city, and everything that benefits the city benefits the central stations. The ornamental street lighting installed in Poughkeepsie last year has been increased materially this year and has brought the name of the city into prominence.

Mr. L. H. Scherck, of Newburgh, N. Y., supplementing Mr. Ives' statement, said that in Poughkeepsie by co-operating with the railway company and with the city a mile of wooden trolley poles were replaced by ornamental iron poles bearing four lamps. Mr. Ives stated in this connection that tungsten lamps mounted on trolley poles suffered no impairment in life.

Messrs. H. K. Mohr, of Philadelphia, Pa.; L. Fitzgerald, Gary, Ind., and E. Creed, New York, also participated in the discussion.

LAMP COMMITTEE REPORT.

The report of the lamp committee, Mr. W. F. Wells, Brooklyn, chairman, mentions several improvements in the method of manufacturing tungsten lamps, and some advances in the standardization of lamp sizes and ratings. It was stated that tungsten units rated at 400 watts and 500 watts have come

into very general use during the past year. In reply to questions Mr. Wells said that he did not think central stations at present could give free tungsten-lamp renewals, and that consumers could not be prevented from buying lamps from contractors and others.

Miscellaneous.

PUBLIC UTILITY APPRAISALS.

In an address on the subject "Breadth of View in Public-Utility Appraisals" Mr. H. M. Byllesby, Chicago, called attention to certain general observations on the subject which can be applied to any method or any detail procedure which from time to time or eventually may be adopted. He expressed the opinion that greatly increased values will be allowed to the properties and going business of all classes of public service corporations in the future as compared with the tendency of either the past or present.

The speaker said that the almost unvarying experience has been that in installing a public-utility equipment the completed cost has largely outrun the estimated cost; this occurs even when the party making the estimates has charge of the construction and the work is done under his supervision and with everything in his favor. It is unfair, therefore, to allow this same procedure to be applied to appraising the cost of a property the construction of which is extended over a period of from a few to twenty years and the history of which construction is not available to the appraiser. In every case the appraiser should give the finished property the benefit of his own personal equation of under-estimating as well as the benefit of any expensive surrounding conditions existing at the time the construction under consideration was installed. Such a procedure would have a pronounced bearing upon the percentage allowances in fixing the value of public-service properties.

In addition to the above a suitable allowance should be made for the going value of the property, which represents its established business which costs more to build up than is generally understood, its large development account and a fair and reasonable dealing with the cost which in some form or another every public service corporation has gone through with in developing the art and experimenting with new systems, methods and apparatus and in learning the business.

Mr. Byllesby expressed the belief that the time will come when there will be a condition of better mutual understanding between the lawmakers and the public-service companies than has existed in the past. If the companies are properly protected they will do their part and continue the developments with the enterprise which has characterized their work in the past.

DISCUSSION.

Mr. Insull, taking the viewpoint of the financier, he said, rather than that of the engineer, declared that plant managers often fail to place a proper value on their own physical properties. He advised operators to take stock of their properties from time to time, securing the services of an outside expert for this purpose, rather than depending upon company engineers and auditors. Mr. Insull cited the case of a company with a yearly income of $160,000, whose manager believed that his actual plant value was far below that represented by his securities, although Mr. Insull declared that no business with an income of $160,000 per annum could be operated with a capital materially less than $600,000 to $800,000, and insisted that in some form or other this value actually existed in the property. The valuation which unbiased appraisal may disclose, often surprises plant operators who heretofore believed themselves to be familiar with their properties. In dealing with regulative bodies, suggested Mr. Insull, the information disclosed in such a report may often prove valuable.

ELECTRICITY IN RURAL DISTRICTS.

Mr. John G. Learned, of the North Shore Electric Company, Chicago, chairman of the committee on electricity in rural districts, submitted a report which deals with the subject in its commercial form alone, not going into any of the technical features—the object being to present a view of the situation from the standpoint of the central station and interurban electric railway, and to stimulate interest in the subject among the members of the association. The report is accompanied by seventy-eight illustrations giving views of the application of electricity on farms and for power purposes in rural districts. The report includes a tabulation of the returns received from a circular sent out by the committee asking for data relative to central-station business in rural districts. It is stated that the basis of development of rural electrical supply rests upon the extension of the lines of central stations in country towns, on connecting with interurban transmission systems and with the transmission distributing lines of interurban railways. In many cases it has been found advisable for a company to bear the expense of bringing the service to the rural customer, although this is not the general practice at present. The rural electric motor load is usually off the peak, and this is very often true with respect to the lighting load. It is believed that a great many rural customers can be secured consuming enough energy to pay the central station for the effort to reach them. If, however, an increased rate is charged for rural service the farmer will not favor its adoption and will turn to other means now continually offered, such as gasoline engines, gasoline-engine-driven dynamos, etc. Business should be encouraged also by means of instalment payments, cost price on wiring and similar inducements.

DISCUSSION.

Mr. H. J. Gille, of Minneapolis, Minn., desired information with regard to the cost of extensions in rural districts and Mr. Learned replied that although his committee had made no attempt to gather such information local conditions would necessarily have to govern. In few cases construction inferior to standard was used.

Mr. S. M. Kennedy, of Los Angeles, Cal., gave information on the lines operated by his company in southern California. The highest standard of construction is necessary owing to liability of interrupting the service. The average cost of the extensions depends on the voltage of the lines and the nature of the territory, ranging from $600.00 to $1200.00 per mile. As a rule his company will make extensions to any distance upon the basis of 50 per cent of the first year's income, the presumption being that in future years the percentage will be considerably increased by the addition of other business. On a 26-mile extension the consumer had to pay one-third the cost of the line. In many instances the consumer owns the transformer, but where the rates are higher and the returns smaller the company usually supplies the transformer.

Mr. J. C. Parker, of Rochester, N. Y., spoke of the very advantageous loads offered in reclamation and irrigation work, as reclamation work especially the reactive effect on the character of the country itself often justifies line extensions. Whatever can be done to increase the density of population in the country makes line extensions there possible. By means of electricity the value of marsh land and also of arid land is materially increased so that eventually the distribution question in rural districts becomes comparable with the present distribution question in urban districts.

Mr. E. L. Callahan, of Chicago, Ill., questioned the profitableness of some rural business and asked whether oftentimes the transformer losses would not more than offset the revenue received. Mr. Parker in replying said he believed that the fundamental and social character of people in rural districts would prolong the lighting load materially if electricity is introduced, and that much other business could be obtained from the operation of farm machinery. If short-hour business prevails the supply company could advantageously group customers on one transformer, ignoring the efficiency and making a considerable reduction in fixed cost.

Mr. L. H. Scherck, of Newburgh, N. Y., suggested that the committee embody in its recommendations a proviso that the data collected might also be issued in pamphlet form for distribution by the central-station companies to their respective consumers in rural districts.

Mr. E. P. Edwards, of Schenectady, N. Y., commenting on the need of specific data on the subject in hand, said it was hard to get information from the farmer and that it would be part of the duty of the expert recommended by the committee to compile this information. He stated that the U. S. Department of Agriculture had published a pamphlet entitled "The Cost of Producing Minnesota Farm Products" which contains accurate and detailed information on the cost of producing every form of farm produce. The bulletin gives the average cost of animal labor and of manual labor; the average cost of animal labor per horse-power ranging about eight cents. With information such as this bulletin contains the solicitor will soon discover where to go in order successfully to compete with animal and manual labor. Specific information is what the farmer needs and as an instance of the interest manifested in the subject he stated that his company had published 10,000 folders on "Electricity on the Farm" which were exhausted in three weeks.

Mr. J. F. Gilchrist spoke of the great headway made in the application of electricity to farming abroad, the farmers there being more advanced than the average farmer in this country.

REPORT ON PROGRESS.

The report of the committee on progress, Mr. T. C. Martin, executive secretary National Electric Light Association, chairman, forms a pamphlet containing ninety-eight pages, in which every phase of central-station development is considered under appropriate heads. The first part of the report treats of the general growth of the industry and its future. Statistics for the past year are given, followed by an account of conditions abroad with data. Sections are devoted to the federal corporation tax, federal lamp suit, electric transmission, right-of-way, physical valuation, rates and public-service commissions. The subject of conservation and water-powers is next treated, after which there is a section on valuation, rates and charges, with particular reference to St. Louis, Los Angeles, Toledo and Montreal. A number of notable new plants and hydroelectric developments are then described, after which steam-power and fuel questions are taken up. The question of illumination is treated under a number of heads, following which is a section on recent central-station methods and conditions, including improved meter reading and house wiring. The final pages of the report deal with events of the year in regard to matters of general public interest affecting central stations.

PUBLIC POLICY.

Questions relating to the environment of the working classes constitute the subject of the report of the public policy committee, Mr. Arthur Williams, vice-chairman. Modern industry depends upon three factors: Capital; direction, executive and administrative, and labor. The harmony of all is essential. The question of wages is a local one, but in the same locality wages should be fully equal to those paid by other employers engaged in similar work. The term "service annuity" is adopted rather than pension as compensation for continuous service over a period of several years. Wages is inclusive of both wages and salaries. Any contribution for the improvement of an employee's surroundings or of himself should not be construed as affecting his wage or as either charity or philanthropy. It is to secure the added service of enhanced efficiency, increased devotion to the employer and more careful utilization of time, tools and materials that the committee has directed its efforts to find a form of compensation reasonable and mutually satisfactory. The suggested forms of relationship between employer and employee include, in brief, accident insurance, sickness insurance and death benefits, service annuities, profit sharing, employees' savings and investment funds and life insurance.

A full account of the report of the committee and the discussion thereon will be found elsewhere in this issue.

MASTER AND MAN.

Mr. Paul Lupke, whose paper has become one of the features of the annual convention, took this year for his subject the relations between employers and employees. The leading note is that in such relations the human sentiment cannot be eliminated as a factor. Though rational welfare plans may make us all friends, and extensive profit-sharing schemes may make us all partners, still masters and men always must be and always will be, and wherever difficulties exist they are largely due to the fact that we have allowed the distance between the two to grow in proportion to the expansion of our business. The result is that the real masters are apt not to know their men, and the real men just as often not to know their masters. Launching an elaborate welfare plan, he said, without any attempt to educate the men up to its appreciation is like sowing good seed in an unplowed field—the crop is bound to be meagre. In the work of preparation nothing is so effective as personal presentation; this our commercial departments learned long ago—they have solicitors. Let him whose mind has conceived a plan try earnestly to imbue those next around him with his own enthusiasm and charge them solemnly to pass it down the line undiminished, step by step, to the last man, and when that is done, and not until then, introduce the formal features. Referring to profit-sharing schemes, he said that it is well to remember that benefits thrust upon one are apt to be considered with suspicion. If one can manage to convince men that not every dollar they can call their own must necessarily be in the vest pocket they are ripe for a profit-sharing plan, as they will then be about ready to ask for it, and that is the psychological moment for its promulgation.

ELECTRIC HEATING, REFRIGERATION, ETC.

In view of the broad scope of the work of the committee on electric heating, refrigeration and kindred appliances, Mr. F. H. Gale, of the General Electric Company, chairman, four subcommittees were formed, of which the chairmen were respectively: Messrs. C. J. Russell, Philadelphia Electric Company; E. L. Callahan, of H. M. Byllesby & Company, Chicago; G. B. Johnson, Commonwealth Edison Company, Chicago; L. R. Wallace, Boston Edison Company. The subjects were considered under the heads of domestic and commercial heating appliances, domestic and commercial cooking appliances, domestic lighting appliances, comprising novelty lamps, portable, fancy lamps, etc., and domestic and small power appliances, comprising domestic refrigeration, ventilation, vacuum cleaning and miscellaneous small motor applications.

It is stated that the flatiron is the greatest electric heating revenue producer singly, the average income being about 65 cents per month. It is estimated that last year 250,000 flatirons were sold in the United States and Canada, or one to every four residence electrical customers. The heating pad is second in popularity, and air heaters and luminous radiators are steadily growing in favor. Encouraging reports were received as to the industrial use of electrically heated tools and appliances, some member companies receiving an income of from $20,000 to $50,000 per year from customers of this class.

The report considers in detail the situation in various industries with respect to electric heat and power, in many cases giving interesting data. The use of domestic cooking appliances was found to be increasing. Details are given concerning a special type of electric cooking range designed for the Cleveland Illuminating Company, which is a combination of a storage heating oven having cooking plates and the radiant broiler of an ordinary electric range. About thirty of these outfits have been installed, and the average monthly bill per person for the last quarter, at the rate of 5 cents per kw-hour, varies from $4.13 for a family of two down to 81 cents for a family of eleven; a family of eight averages $1.41, and the average of four families of five persons each was a monthly bill of $2.54 per person. Answers are given to sixteen questions sent out to central-station companies relating to electric cooking. Two stations report their cooking rates to be 5½ cents per kw-hour; nineteen, 5 cents; one, 4½ cents; one, 4 cents; five, 3 cents, and two, 2.4 cents. All stations answering

questions as to the minimum charge said that this was $1 per customer. There are cooking installations in hotels, restaurants, clubs, factories, etc., in Los Angeles (twenty), Chicago (fifteen), also in Brooklyn and Atlanta, Ga. The possibilities of commercial electric cooking are reported to be encouraging.

In a report on home refrigeration it is stated that one manufacturing company has sold in the vicinity of New York City and New Jersey 170 one-quarter-ton outfits, which are economical for any household which uses 40 lb. or more of ice per day. The use of ozone generators is said to be extending, and this apparatus promises a use of electric current that will grow in this country as it has done in Germany and other European countries. The electric vacuum cleaner is becoming very popular, and where placed in service invariably gives satisfaction.

DISCUSSION.

At the conclusion of the reading of the report and in lieu of any discussion, motion pictures were thrown on the screen showing the application of electricity to the servant problem. The films, which were loaned by the Commonwealth Edison Company, depicted scenes in a household bereft of any electrical conveniences; the purchase of the latter in the Edison Shop and the happy domestic changes resulting from their installation.

CENTRAL-STATION INSURANCE.

In his report as insurance expert of the association Mr. W. H. Blood, Jr., of Stone & Webster, recalled that at the meeting last year figures were presented showing that the fire-insurance premium rates on electric-light and power plants were on an average about twice as high as the losses warranted, and that resolutions were passed calling the matter to the attention of the Underwriters and asking for such reduction in rates as the facts justified. The effects of these resolutions, Mr. Blood states, have been beneficial, although the matter has not received the full attention which its importance warrants. In some cases the effect was almost instantaneous and reductions as high as 50 per cent have been reported. Letters from underwriters were quoted, which indicate that the insurance people, as a rule, do not know whether central-station business is particularly profitable or not. While in certain geographical localities it is probable that no injustice exists, yet in certain other places scientific rating has received little, if any, attention. The Central Traction Lighting Bureau last year formulated a schedule with a basic rate of 8 cents in place of rates running from 25 cents to $1.25, each rating bureau having previously established its own basis. A few of the Underwriters' bureaus have adopted the new schedule, and where it has gone into effect there has been a reduction of approximately 35 per cent in premiums. Referring to the Underwriters' wiring rules, it is stated that there is a constant tendency to increase the requirements unnecessarily. It is recommended that member companies give more attention to seeing that new wiring installations to which they connect are in accordance with the National Code and that old installations are safe, as there will then be little demand made by the inspectors for something better. While it is imperative that the association shall stand unequivocally for safe wiring, it must also do all that it can to see that the cost is kept as low as possible.

VALUATION OF PLANT AND PROPERTY.

Mr. W. F. Wells, general superintendent Edison Electric Illuminating Company of Brooklyn, presented a paper on the subject of "Elements Affecting the Fair Valuation of Plant and Property," several member companies having requested information for use in the preparation of evidence in connection with rate cases, sale of property, additional capitalization, etc. The paper considers two of the factors, the approximate original cost and the reproduction value of that part of the property which is represented ordinarily by the fixed capital accounts. To obtain such estimates it is suggested that exhibits be prepared as follows:

1. Net cost of property to date, consisting of original cost with betterments, additions, improvements, withdrawals and renewals as made during a term of years. 2. Reproduction value. 3. Allowance for accrued depreciation or deferred maintenance. 4. Increment value of real estate and other property. Either the standard classification of accounts of the association or the classification prescribed by the New York Public Service Commission, First District, is suggested for use in the preparation of exhibits.

Exhibit 1 should be prepared from books and records, but the costs should be distributed, where possible, in accordance with the classification. Where charges have not been so segregated and evidences of cost of individual items are unavailable the distribution may be estimated. This should show the credits to fixed capital accounts for property withdrawn and charged against surplus or reserve accounts. It should show accumulated reserves, and should indicate whether it has been the practice of the company to make betterments and replacements out of earnings and to charge the cost thereof directly to operating expense accounts each month. The same treatment should be given to administration, engineering and general expenses and costs of developing the business which were met from earnings and thereby diminished the net return on the capital investment. Profits that were earned and not distributed, but were reinvested in the property, are justly part of the total cost.

Exhibit 2 should consist of a complete inventory of tangible and intangible property properly chargeable to capital as a part of the unimpaired investment. The cost of reproduction may be determined by present unit cost of labor and material delivered, except where prices are affected abnormally by temporary market conditions. These figures would represent the cost to a sub-contractor; overhead charges for contractor's profit, administration, engineering, incidentals and extra expenses incurred in construction which are not apparent in the finished work should be added. Proper allowance should be made for the term of years during which the work was actually done. The existence of intangible property is recognized by all courts, and several methods are in general use for the determination of the fair value.

If the accrued depreciation of any part of the property resulting from normal service or accidents has not been made good by proper repairs and renewals through charges to operating expenses, an allowance should be made for deferred maintenance, but if normal repairs have been made, and the original usefulness or earning ability of the property is unimpaired, no allowance should be made for normal wear or tear. Property inventoried and permanently withdrawn from service, but not yet sold, should be subject to an allowance for depreciation representing the difference between the reproduction cost and the sale value.

For the following reasons it is erroneous and illogical to assume that the reproduction value of the property is decreasing as the result of depreciation: On this basis, if a company had operated for a number of years its property taken as a whole, excepting real estate, might have depreciated 50 per cent of its service value, because one-half of the estimated physical life thereof had passed, even though the property hac been kept in good repair and its original utility was unimpaired. A company managed in accordance with this theory would have a surplus or depreciation reserve equal to nearly one-half of its outstanding securities, and if these funds were reinvested in property of the company the earnng power would be enhanced correspondingly. If a company should accumulate a depreciation reserve fund upon this basis, its rates during the early period of operation would have to be so high that the business could not be developed.

Any so-called depreciation which does not affect utility should not be considered as impairment of capital, but rather as unaccrued expenses, as the replacement or withdrawal of the property in this case would be charged to operating expenses when the earning capacity actually ceases. Even though depreciated property is replaced from earnings, it is sound business policy for a company to maintain a sufficient amortization re-

serve to provide for any reasonable depreciation that may accrue during the following year, in addition to a surplus sufficient to meet dividend requirements for a year in case of adverse business conditions. No company, however, should be required to maintain a fund for all future unaccrued depreciation, any more than for interest of future years. Unaccrued depreciation will be offset by unaccrued earnings.

Exhibit 3 should show only such deductions as are to be made from the reproduction values in exhibit 2 on account of (1) obsolete or inadequate property withdrawn from service, but not yet sold or charged off, and (2) property whose utility is impaired because of deferred maintenance or repairs, accidents or other causes.

Exhibit 4 should show the increases in value in some parts of the property, the aggregate of which may more than offset accrued depreciation of deferred maintenance. Increment value of real estate may be shown by the difference in assessed values. Increment value of subway ducts or other sub-surface structures is shown by the difference between original and reproduction costs. It is also possible that there may be an increment value in buildings, due to increased costs of material and labor and shorter working days.

DISCUSSION.

Mr. Henry Floy, of New York, opened the discussion with a reference to the confusion which incompletely defined terms may cause. He discusses the various meanings of "service value," "wearing value," "salvage value" and "junk value," and distinguished between absolute or sensible depreciation and theoretical depreciation, by which he characterized the writing off of value on equipment yet rendering full service. Mr. Floy also spoke of the lack of definite data on the life of outside-line materials and equipment. Mr. F. H. Peckham, Providence, R. I., referred to the differing rates of depreciation encountered, and suggested the appointment of a committee to investigate the subject. Mr. J. W. Lieb, Jr., New York, declared that a saving of both time and money might be expected to result from the employment of outside appraisal experts, even though such service proved expensive and the company might have within its own organization men capable of doing the work. He also referred to the importance of obsolescence and changes in apparatus types in affecting service rates to customers. In closing Mr. Lieb urged the necessitty for making allowance for depreciation on the books of the company, pointing out that in case of a contest on the subject of rates the advantage of such a fund on the books would be obvious, although it would not be possbile to introduce it after the contest was in progress. Mr. Alten S. Miller spoke of the importance of capitalizing the cost of building up the business and said that certain progressive commissions, among them that of Wisconsin, allow the company a right to a reasonable return during the time of building up the business. In discussions before persons or bodies unfamiliar with corporation accounting terms, Mr. Miller advised the use of the expression non-inventory property instead of non-tangible property. Mr. H. C. Abell, San Antonio, pointed out how good management of a plant may often be penalized by commissions which seek to make proper allowances for earnings and depreciation. Mr. J. F. Klump, of Philadelphia, dwelt on the importance of going value. In 1908 he said the American Waterworks Association adopted a scheme for computing this intangible quantity, which he believed applied to the electric light situation. According to this scheme it was the plan first to consider the plant completed, but with no developed business. The cost of developing this service was then estimated and proved to be a very actual value. Mr. Wells, the author of the paper, acknowledged his difficulty in selection of words to express the ideas which he had in mind, and declared for this reason he had undertaken to define the expressions used.

THE ELECTRIC VEHICLE.

The report of the committee on electric vehicles, Mr. J. T. Hutchings, general manager, Rochester Railway & Light Company, chairman, discusses the use of the electric vehicle in central-station work under the following heads: General hauling of all kinds; hauling of heavy materials, such as transformers, reels of cables, etc., in which the electric winch is indispensable; application of electric vehicle in construction of aerial lines; use of electric vehicle in underground work; the electric-tower wagon, and the adaptability of the electric vehicle as an advertising medium. The committee very strongly emphasizes the desirability of every central station using the electric vehicle in its own work, first, on account of the saving and economy; second, as an encouragement to the manufacturers, and, third, as an encouragement to those in the community who could use electric vehicles with economy and satisfaction. It is pointed out that a number of up-to-date organizations are using electrically illuminated vehicles for the advertising of their wares after dark and that central stations might make a similar use of them to great advantage. As a moving power plant, through it all sorts of devices can be shown in operation during the evening hours, and many companies have found that the lighting of lawns for lawn fêtes, fairs, etc., can be accomplished cheaply by the use of storage batteries of vehicles.

From returns received from various manufacturers it appears that 4513 electric-pleasure vehicles were sold last year. Referring to competition between the electric and gasoline trucks, it is stated that manufacturers of the former are handicapped for the reason that they are unable to put out enough vehicles to reduce the selling price to an equality with that of the gasoline truck. Moreover, up to the present time there are no reliable data as to cost of operation, the result being that the electric vehicle is not receiving the attention at present which it deserves. The report urges strongly the compilation of operative data, stating that the electric vehicle cannot be effectively exploited among merchants if the central stations have no reliable information as to cost of operation.

From reliable data carefully compiled over a period of three years the report gives the following data applying to 1½-ton wagons: Average days in service per month, 24½; average miles per day, 29½; average kw-hours per mile, 0.491; oil and other supplies per mile, 0.6 cent; general repairs per mile, 1.4 cents; electric energy at 4 cents per kw-hour, per mile, 2 cents; tires per mile, 1.62 cents; batteries per mile, 1.7 cents—making an operating cost of 7.32 cents per mile. For total operating expenses there should be added the salaries of drivers, cost of washing and minor repairs, and garage expenses. The committee has found that there is a difference of from 30 per cent to 70 per cent against the heavy gasoline type of tire as regularly sold in favor of the best special electric tire on the market. This means that the latter will give nearly double the mileage and double the life of the tire, if the vehicle is given proper attention otherwise. This question of tire efficiency will often account for the increase in electric bills and complaints from consumers having pleasure vehicles.

Owing to the slower speed, more perfect control and lack of complexity of the electric vehicle liability-insurance companies are beginning to realize the greater safety of the latter and to make a material rate difference in its favor. Fire-insurance companies recognize the lower hazard of the electric trucks and allow it on wharves and in sheds and warehouses where the gasoline truck is prohibited. Where electric garages can be satisfactorily fitted with a sprinkler system a very low rate of insurance can be obtained. Central stations intending to inaugurate an electric-vehicle campaign are advised to send a man from their organization for a month or six weeks to the various manufactories where electric vehicles are being built and assembled or to make arrangements with a station at present handling the vehicle situation satisfactorily to take on their man and give him a thorough insight into the practical part of electric-vehicle maintenance. Every central station should decide for itself immediately whether it will confine itself to co-operating with all electric-vehicle manufacturers and dealers, or whether it will sell electric vehicles directly; in the latter case the station should co-operate with the dealers in so far

as possible. An abstract of the report relating to electric-vehicle accounting appears under the head of "Miscellaneous."

DISCUSSION.

Mr. P. D. Wagoner, Long Island City, brought out the importance of keeping accurate cost records. Examination of many so-called records of horse, gasoline and electric-vehicle equipment demonstrated no uniformity in method. The results have, therefore, not been comparable, and in some cases the vehicle owners have entirely overlooked the question of fixed charges. He felt that there was nothing more important from the central-station standpoint in the extension of electric-vehicle applications than comparable results giving the cost of operation of the three types of transportation. Referring to tires, Mr. Wagoner said that he remembered a test where the energy consumption was 75 per cent above what was considered the standard. It is of the greatest importance for every user of commercial vehicles to obtain tires which will give the proper consumption results, otherwise his mileage per charge will be very unsatisfactory.

Mr. Day Baker, Boston, called attention to the fact that the insurance of electric vehicles is certain to be reduced if the proper statistics can be placed before the insurance companies. The Electric Vehicle Association has the assurance already from two of the largest companies to the effect that they will reduce the insurance on electric vehicles if given something to work upon in the way of data. Blanks are being sent to all central stations and to all known users of electric vehicles, and the co-operation of every one was asked in filling out the forms. In Boston the fire underwriters permit the electric vehicles to be stored in the center of the city, whereas gasoline cars cannot be garaged in the business district.

Mr. W. H. Blood, Jr., Boston, said that, in his opinion, many managers do not realize the importance of the electric-vehicle load. Probably 90 per cent of it comes off the station peak. He felt that there was nothing in sight so easily handled without additions to capital and stations as the charging of vehicle batteries. It is desirable for central stations to give up using gasoline cars where they could better use electric vehicles, although it is inadvisable to advocate the use of electric vehicles for every service. The electric vehicle is not intended for touring purposes, but it has a legitimate field of its own in the trucking business, carrying heavy loads at low rates of speed and with limited mileage.

Mr. R. L. Lloyd, Philadelphia, stated that two manufacturers have received more orders to date this year for commercial vehicles than during the entire year 1910. Mr. Wagoner stated that the sales of his company for the month of February, 1911, were considerably more than the sales of the total year of 1908 and about the same as 1909.

Mr. Frank W. Frueauff, Denver, emphasized the need of greater activity in connection with electric vehicles. On his system a careful canvass has been made of all the users of gasoline vehicles and the advantages of the electric machine are being placed before them. He stated that a solicitor should feel as much responsibility for a man who purchases a gasoline car as he would for a merchant who establishes a gas-engine plant in the central-station territory.

Mr. H. S. Knowlton, Boston, spoke briefly in regard to the benefits of the electric-vehicle weekly luncheons which the Edison Electric Illuminating Company of Boston has lately been giving. Each Wednesday noon all representatives of electric-vehicle manufacturers located in the Boston district gather at the Edison Building for a pleasant social hour, after which, under the oversight of the chairman elected each week, a large number of imparted topics in connection with the development of electric vehicles in the district are discussed. It is inspiring to see these competitive interests putting their shoulders to the wheel with the single object of advancing the industry. Reference was also made to the recent decision of the Boston Edison company to replace all its gasoline and horse-drawn vehicles by electrically driven machines. On Memorial Day an electric-vehicle parade occurred in Boston in contrast to the annual work-horse procession, sixty-two electric vehicles being in line. Through the courtesy of Mr. Thomas A. Edison arrangements were made to have a moving picture taken of the parade and these moving pictures will be used by Mr. Baker in some of his lectures upon electric-vehicle transportation in the New England territory.

Mr. C. F. Smith, Boston, stated that the Edison company had sixteen trucks in line on Memorial Day. He brought up the point that in keeping records he had been confronted with serious difficulty on account of the use of auxiliary motors in some of the vehicles. The company's records are kept on a mileage basis and consequently it has been exceedingly difficult in many cases to determine the efficiency of the vehicles from the electrical standpoint. Frequently a truck will run less than a mile, consuming not a little energy in auxiliary service, and he asked if any of the members could advise a good method of properly crediting the value of the work which it does.

Mr. George H. Whitfield, of Richmond, Va., stated that his company had been careful not to enter into competition with local dealers. The policy is to do everything possible to assist local dealers in recommending cars, but the garages were smaller and irresponsible. Business was poor in the line of car sales on account of the lack of reliable garages. The central-station company finally announced that it would take care of the cars if anyone would find satisfactory facilities, and the immediate result was the increase in the sale of electric vehicles. The company has not been obliged to take care of a single car as yet, the mere announcement of its willingness to perform garage service being sufficient.

Mr. J. W. Brennan, Detroit, suggested that the problem of keeping records of vehicles with auxiliary motors could be handled either by two meters, one on the drive circuit and the other on the auxiliary wire, or by an amp-hour meter, the later being read when the vehicle comes to rest. Mr. Brennan stated that in spite of the fact that Detroit has the reputation of being the banner gasoline town in the country there have been sold there in the past six months about fifty electric commercial vehicles, and when one considers the handicap of competition existing there, both through loads and sometimes through price-cutting, such a record is remarkable and emphasizes the fact that the gasoline truck in a great many cases is unsatisfactory and that the users of transportation are on the lookout for the best equipment for a given service.

Mr. M. S. Seelman, Jr., Brooklyn, called attention to the road run recently initiated by a New York news company with a very large circulation. The publicity which this affair received was of great value to the electric vehicle, many central stations, manufacturers, owners and operators entering the contest. The newspaper that promoted this plan gave a great deal of space to the affair, and the electric vehicle came in for its full share of publicity. Many commercial vehicles have been purchased in Brooklyn within the past few months. Two of the largest department stores have announced the discontinuance of their horses for deliveries, and about half of their total of 150 delivery wagons have already been replaced by electric vehicles. The Brooklyn Edison company is also a very large user of electric vehicles and proposes to do everything that it can with this type of automobile.

Mr. Egbert Douglass, Milwaukee, emphasized the importance of the quality and extent of pavement upon the analysis of results in different cities of the same population. The large mileage of asphalt streets in Buffalo tended to make it a comparatively easy city in which to exploit electric vehicles.

Mr. Day Baker referred to a 5-ton truck which was six years old on the day of the electric-truck parade in Boston. For four years this machine has been operating over unpaved streets in the outskirts and it is apparently good for six years more. It appeared almost a duplicate of a new machine which made its initial appearance on the same day. A life of twelve years should easily be realized even under adverse conditions.

Mr. R. W. Rollins, Hartford, Conn., stated that the cost of

energy for runabouts in his companys service figured about 1 cent per kw-hour, or was about 50 cents per week each. On the same basis 1000-lb. vehicles cost about $1 : week. The company feels that the business will have to be pushed pretty hard in order to amount to much in the way of selling energy.

Mr. S. M. Kennedy, Los Angeles, emphasized the importance of getting rid of gasoline cars at present used in central-station service. It was his opinion that in the present high state of efficiency of electric trucks and vehicles central stations should rely for their delivery service upon electric runabouts only. He had never seen an electric-lighting company's office illuminated by gas, or vice versa, and was of the opinion that the central station must set a good example if it is to induce consumers to put money into such equipment. It is a very difficult thing to ask a man to buy an electric truck for his business when the electric company has gasoline cars running around town.

Mr. E. F. McCabe, Titusville, Pa., inquired about the use of flat rates in selling energy for electric-pleasure vehicle service. His company has about a dozen runabouts and pleasure vehicles, selling energy at the rate of $60 a year per machine. A revenue of about 8 cents per kw-hour is the result of this arrangement. Mr. J. R. Brennan said that the practice in Detroit is not a flat rate, the company's plan being to make a low energy rate of about 4 cents per kw-hour, installing a separate meter for commercial-vehicle service.

Mr. E. L. Callahan, Chicago, stated that in Oklahoma City the company has five electric wagons and one runabout. The runabout has paid for itself in connection with the new-business department's work already. The town is growing so fast that it is almost impossible to anticipate the demands of manufacturers and save a great deal of business thereby. In one year the revenue from energy sold for charging purposes grew from practically nothing to $600 per month, and at present the revenue from this source is about $1,000 a month. There are about 350 electric vehicles in the city of Oklahoma. He did not agree that the business is not going to be very lucrative, but emphasized the importance of selling energy at considerably above 1 cent per kw-hour.

Mr. Rollins said that the Hartford company had no intention of selling energy for charging vehicles at any such price.

Mr. H. L. Parker, Baltimore, stated that his company has a flat-rate proposition of $25 per month for maintaining and charging 1000-lb. trucks. A large milk dealer which the company had in prospect was discouraged about the use of electric trucks on account of the cobblestone pavements. The company loaded a 3½-ton truck to about 57 per cent of its capacity and hauled milk for this dealer very satisfactorily for three days over the roughest part of the city.

Mr. T. I. Jones, Brooklyn, contended that the price charged for energy is a point vital to the sale of electric vehicles. He felt that if the electric vehicle is going to be pushed at all it must be along economic lines. He advocated compiling the results which have been obtained from certain rates by various companies in the development of the sale of electric vehicles, including rates which are not remunerative as well as those which are profitable.

Mr. E. W. Lloyd, Chicago, reviewed the practice of the Commonwealth Edison Company in pushing electric vehicles, stating that about forty vehicles are in use in the transportation department alone. The contract department has decided to use electric vehicles for transportation rather than gasoline. The company employs a battery expert who is doing a part of the work of an educational character among private-vehicle owners and garages. The company's energy charge for vehicle service is 4 cents per kw-hour maximum. In some of the larger garages the rate goes as low as 3 cents. To-day there are not more than half a dozen isolated plants in Chicago garages. The department store of Marshall Field & Company is buying additional electric vehicles from time to time. The speaker believed that the small commercial electric vehicle has a wide field for local delivery. In larger cities department stores have outlying distribution centers from which deliveries take place, and there is an admirable opportunity in this direction for expansion. The prospects will be better if the people in these stores are educated to use local delivery wagons, gradually working up to the larger sizes. The heavy truck is economical, but in connection with store business the use of the small vehicle should be strongly urged.

Mr. Arthur Williams, New York, said that there is a tendency to place too much emphasis on the rate for electric energy and advocated the use of electric vehicles. Assuming in any event that the rate payable for energy seems high, it stands to reason that anyone requiring service of that character cannot afford to use electric energy if he is going to place emphasis on its price. Whatever the energy rate may be, it is competitive, either with the horse on one hand or with gasoline on the other. Emphasis should be placed on the other services rather than on the energy because the latter is an incidental matter. The electric vehicle men are far too modest in the service claims for their equipment. The controlling considerations are cheapness, simplicity, economy and longevity. The only vehicle that can stand the strain and bear all comparison in the delivery service of large cities is the electric. In one department the speaker found that one truck would replace thirteen horses, and in still another that the ordinary 2000-lb. wagon would replace eight horses. Mr. Williams held that all that has to be done is to show the superiority of the service, the simplicity of the management and the low cost of delivery; if we can show this it will make a very serious encroachment on the pleasure field which is now largely occupied by the gasoline machine.

Mr. Peck closed the discussion by thanking Mr. Smith for calling attention to the importance of keeping records of auxiliary apparatus, and Mr. Brennen for his suggestion as to the methods of keeping such records. In neglect of the records of energy and cost it would make the performance of these particular vehicles much worse than as though no record were taken whatever. Mr. Brennen's suggestion of having two meters appeared to be the best. Mr. Peck questioned the practicability of using the ampere-hour meter before and after the use of the auxiliary motor, on account of the unreliability of readings taken by drivers. He did not think that the flat-rate system could be satisfactorily applied to vehicle charging unless it is combined with the garage maintenance at a figure which would be particularly profitable to the central station through a period of years.

Mr. George R. Stetson, New Bedford, Mass, reviewed his experiences in purchasing electric vehicles for service on the system of his company. He started with a 1000 truck used in taking care of meter service. The first expense incurred in two years has been a set of wheels at a cost of $158. This truck has been run over 2000 miles, and has accomplished the work of two horses and four men during the two years of its service. Snowstorms have not interefered with its operation, and in one instance a second truck of one-ton rating has very largely repaid its initial cost. Four trucks are now in service at New Bedford, the largest being a 3½-ton outfit. The latter is used for the distribution of coke and the handling of the supplies for the gas department. The first piece of work it performed was to haul a 35-ft. pole 8 miles, with a body of men to erect the pole, and the cost of handling the work by the usual method of trucking the pole with a horse and sending the men with a team would easily keep the truck running for several days.

Commercial.

ADDRESS OF CHAIRMAN OF COMMERCIAL SECTION.

In his address at the opening of the Commercial sessions, Mr. George Williams, of New York, chairman of the Commercial Section, called attention to the fact that the latter has already enlisted a membership as large as that of the entire association six years ago. He stated that there is no association work with a commercial side to it that cannot best be

developed through the Commercial Section. In public-utility work there must be harmony among customers, central-station men and supply men if the right kind of service is to be obtained. The Commercial Section affords opportunities for commercial men to acquaint manufacturers with the wants of consumers and for the manufacturers to educate the commercial men. The greater this amalgamation the more rapid the results. The process of simplifying and popularizing things that are intricate or technical demands the co-operation of scientific and commercial men. The author foresaw the time when the work of the Commercial Section would reach a point of specialization to warrant 50 special committees. He called attention to the fact that the reports compiled do not embody one-man opinions or clerical compilations, but the findings of groups of men of broad experience. He suggested the affiliation of the committee on the "Electrical Solicitors' Handbook" with the Commercial Section, and said that the section, although well established, will find its greatest usefulness is yet to come.

DISCUSSION.

Mr. C. N. Duffy, of Milwaukee, Wis., inquired if it would be feasible to bring about the amalgamation of the Electrical Solicitors' Handbook Committee and the committee of the section. The chairman suggested deferring the answer to this question until the second commercial session.

STANDARDIZING ELECTRIC SALES.

With the above title, Mr. Douglass Burnett, of the Consolidated Gas, Electric Light & Power Company, of Baltimore, presented a paper advocating that the selling program of central stations should be on a strictly business basis, capable of tabulation and specification. The things that are sold and their prices should be clearly outlined and described for the purpose of instructing solicitors, making explanations to prospective customers and to complaining customers, and for meeting most effectively all demands for service and for equipment. A campaign for the sale of central-station output cannot effectively be conducted until rates are clearly set forth in pamphlets obtainable without the necessity of verbal inquiry, and until the details of equipment to be sold have been thoroughly worked out and a complete price list formulated. The author gives the practice of his company with respect to forms of schedules, its selling organization, prices for equipment, etc. There are eight schedules covering various classes of service, which include provision for extension of the mains for establishing service connections, both overhead and underground, etc., the prices being quoted on an easily understood basis. The selling organization of the company is described and complete details given as to prices fixed for various kinds of work. Lighting installations are charged for at a uniform price per watt. For a minimum order of 240 watts the price for the complete wiring and equipment of a store is 8 cents per watt or 5 cents per watt if wiring and switches are already installed; in the latter case any outlets requiring more than 5 linear ft. of molding and wire are charged for at the rate of 8 cents per watt. These prices include any of six styles of fixtures. Terms for work are cash in twelve monthly payments. For house wiring the charge in the case of a two-story, six-room house, or one-story bungalow, is 6 cents per watt for an average of 50 watts to 55 watts per outlet, less 0.6 cent for each watt over 55 watts, except that 4 cents per watt is charged for every 75 watts per outlet. For residences having one or more floors above the first floor, and two-story, three-story or four-story houses built in rows, or two-story or three-story semi-detached or cottage-type houses, 7 cents per watt is charged for an average of 50 watts to 55 watts at the outlet, less 0.6 cent for each watt over 55, except that 4½ cents per watt is charged for an average of over 80 watts per outlet. For a still better class of residences the charge is 8 cents and 5½ cents per watt instead of 7 cents and 4½ cents as in the preceding case. The paper gives many other details as to charges for various kinds of lighting installations and information is also given regarding the conduct of advertising campaigns and the work of solicitors.

RATE RESEARCH.

The report of the rate research committee, Mr. John F. Gilchrist, of the Commonwealth Edison Company, Chicago, chairman, confined its recommendations this year to rates for residence business, believing it wise to defer the consideration of general schedules until after some progress has been made in establishing uniform rates for residence lighting. A considerable portion of the report is taken up by the description of a graphical three-dimensional method for the study of electric rates, of which the mathematical theory is given in an appendix. An examination of schedules received from member companies indicated in most instances a surprising similarity. In the case of companies which have given study to the subject the rate curves are not only strikingly alike, but there is only slight variation in the actual cost to the consumer, these remarks applying where conditions are approximately the same for the business which forms the bulk of the company's income. In a comparison of the rates of companies where the elements of operating cost were approximately the same, the net charges per kw-hour were found to be very similar; however, in rates applying to the class of service where a maximum rate is generally charged, and which affords the smallest income to the company, there was very little uniformity either in schedules or net cost to the consumer.

The committee strongly recommends a campaign toward establishing among central station, so far as practicable, a uniform system of rates. Then each company could point out to its customers that its system of rates was in general use throughout the country. This would be particularly desirable in the case of customers dealing with more than one lighting company, which class is yearly growing greater in number and importance. With such a uniform system of rates new companies would be deterred from establishing schedules of unreasonably low rates, which frequently happens under present conditions, and as such low rates are always widely advertised they reflect discredit upon the reasonable and proper rates charged by other companies for similar service.

The committee believes that a campaign for national uniform rates could best be started by establishing, first, a schedule for residence customers. With this in view the committee makes the following recommendations as to residence rates:

The committee is of the unanimous opinion that the charges as a whole should be no more than sufficient to pay expenses, plus a profit high enough to attract capital into the central-station business. This, however, does not mean that each customer should necessarily pay the same profit or give the same return on his portion of investment as every other customer, so that a so-called maximum rate, with the customary minima for meter rent, break-down service, etc., will be entirely proper, especially when demanded by public opinion, even if some particular customers are an apparent loss.

The committee is by no means unanimous as to whether any rate should include a minimum charge per month or per year. It is not unanimous as to whether a differential for residence business is desirable, but is unanimous that, if adopted, either a wholesale or a differential based on hours' use of maximum or its equivalent is the best.

The committee recommends that floor space is the simplest, fairest, cheapest and most practical, constant and easily understood method of determining such a differential, although it has no recommendations to make as to whether this should be used directly or reduced to the number of rooms.

CENTRAL-STATION ADVERTISING AND PUBLICITY.

The report of the committee on advertising and publicity, Mr. C. W. Lee, of the C. W. Lee Company, chairman, is divided into two sections, one of which considers regular central-station advertising and the other the use of newspaper advertising pages by central stations in setting forth its status as a public utility in case of hostile attack. Numerous illustrations are given of effective advertisements and of publicity "talks" bearing on rates, regulations, franchises, etc. Twenty central stations serving cities with a population from 20,000 to 50,000

reported an average of $1,500 expenditure per annum for advertising. The average for seventeen companies in cities from 50,000 to 100,000 population was $2,500 per annum; three companies in cities between 100,000 and 200,000 population expended an average of $6,300, and the average for fourteen companies in cities over 200,000 population was $31,660. The replies indicated that over $2,000,000 per annum is being expended annually for central-station advertising. The report includes accounts of advertising campaigns in various cities and of advertising assistance rendered to central stations by manufacturing companies.

DISCUSSION.

Mr. H. K. Moore, Philadelphia, pointed out the opportunity afforded by accidents for the preaching of service reliability. Considerable success had attended publicity put forth in Philadelphia recently in the newspapers in connection with an accident at the station, the company laying special stress upon the rapidity with which service was re-established. Mr. Moore felt that the committee can be made of greater value to the smaller companies, if the latter will send in accounts of special problems in publicity work which may oppress them from time to time, and he stated that the committee may frequently be in possession of information of decided value to such companies. Mr. M. S. Seelman, Jr., Brooklyn, agreed with this and spoke at length upon the importance of regular and close association between the advertising and commercial departments of the company. Not a day should be allowed to pass without the advertising department getting the benefit of the changing conditions and the opportunities for special publicity which are constantly apparent in the experience of those in contact with the great public outside.

Mr. F. H. Gale, Schenectady, outlined a plan by which central-stations will send to electrical manufacturing companies the names and addresses of prospective builders of houses, apartments, office buildings, factories and other structures in which electricity can profitably be used. The latter manufacturers will then in turn send to such people special and general publicity matter describing electrical apparatus of interest. Mr. Douglass Burnett, Baltimore, pointed out that such information can also be obtained from many additional sources. Mr. J. Robert Crouse, Cleveland, called attention to the "People's Electrical Page" which has been run in a prominent newspaper of Cleveland for about two years. Great success has been obtained by the use of this method of advertising, in which both paid publicity matter and reading notices are placed side by side on a single page. A person cannot run through a metropolitan daily having a page devoted exclusively to electricity without obtaining some new ideas which often result in the purchase of current-consuming apparatus. Vice-Chairman Williams cited a sale of a residence electric elevator solely through catalogue sent to people of means, and he also stated that in one medium-sized city seven such elevators have been placed in service largely on account of the social distinction conveyed by the installation of the first machine. He felt that the committee's report is the most useful and interesting of its kind thus far presented. Closing, Mr. Lee urged giving greater attention to the publicity needs of smaller central-stations, especially in connection with supplying them with the complete publicity data of a specific campaign. He re-read a letter from Printers' Ink commending the work the central-stations are doing in the advertising field.

ELECTRICAL ADVERTISING.

The report of the committee on electrical advertising, Mr. E. L. Callahan, of H. M. Byllesby & Company, Chicago, chairman, refers to a bulletin on electrical advertising, consisting of reproductions of successful electrical displays now being operated in various parts of the country, a copy of which has been given to each member of the Commercial Section. The engineering data in the bulletin will, it is believed, be of much assistance in preparing specifications for electrical displays. The committee has investigated a large number of sign ordinances and submits in its report a model sign ordinance, consisting of seventeen sections, as a suggestion to central stations which desire to take up the subject with a city government. An investigation on the subject of the character of electric signs has brought to light many cases of signs so crudely designed and constructed as to have little or no value. Central-station companies are advised to prevent sketches and specifications for signs from being placed with incompetent persons for their execution. It is pointed out that at present electric advertising is a high type of the art, and its dignity should not be endangered through inferior design and workmanship and improper installation of electric signs.

DISCUSSION

Mr. E. A. Mills, New York, emphasized the importance of preparing sign legislation with great care. An ordinance in New York City limiting the height of signs has been declared unconstitutional. The New York Edison Company has an expert designer of signs who co-operates with the consumer, and before any installation is made submits sketches to him. These sketches and specifications are then sent to competitive sign manufacturers. Mr. Frank Hammond, Birmingham, outlined the favorable conditions under which his company operates, with particular reference to sign ordinances. Plans for prospective signs are submitted to manufacturers without discrimination. Some trouble has been experienced by the company from the burning out of five-watt tungsten lamps in alternating-current service. No difficulties have been noted with similar lamps operated by direct current. Mr. T. K. Jackson, Mobile, contended that liberal sign ordinances are likely to lead to abuses, on account of the freedom with which irresponsible structures can be erected. He was greatly in favor of placing the control of sign installation under the supervision of some single municipal authority qualified to pass upon the vital factors involved.

Mr. J. F. Gilchrist, Chicago, spoke in high terms of the committee's report. He pointed out the need of exercising a large amount of diplomacy in connection with the sign problem. He felt that any sign which is in a sense an obstacle should serve some purpose which justified the inconvenience of its position. Under proper conditions there is no question that signs are of great benefit to a municipality. The speaker thought that the situation in many cities was the payment of a rental to the municipality to cover the cost of inspection. Accidents are very serious in their effect upon the development of new-sign business. The business is sufficiently profitable to enable the central-station companies to pursue a liberal and tactful policy. The member companies themselves should do everything possible to exercise a closer surveillance of sign practice in their respective territories. As a rule, agitation comes from the installation of signs in the face of public opinion, particularly such examples as are flagrant violations of good taste or of safe construction. The policy of patronizing local sign-makers is a good one where the work can be done on a thoroughly sound mechanical and artistic basis. But preeminently a business should be given to concerns doing the best work. Mr. Gilchrist also pointed out the need of united action by the association in regard to freight rates on electric signs. The best which can be done at present is a rate of practically double the first-class tariff, and there is little doubt that if the association takes up the matter properly some reduction will be in order.

Mr. H. L. Parker, Baltimore, pointed out the adverse influence of a sign accident which occurred in Philadelphia some time since, at a period when the Baltimore company was inaugurating a campaign of publicity on behalf of a wider application of electric signs. Six weeks of double advertising were required to overcome the handicap, and as the sign which fell in Philadelphia was not of the electric type the circumstances indicated the importance of endeavoring to keep some sort of supervision of every kind of sign used within a company's territory. Mr. Parker felt that a rate per lamp for electric sign service is preferable to a kilowatt-hour charge. Mr. C. A. Litttlefield, New York, favored strict

municipal ordinances, and also advocated the use of a flat rate. The object of the sign business is to cultivate long-hour service and this cannot be done by a kilowatt-hour charge as ordinarily instituted.

Mr. C. A. Littlefield, New York, pointed out how the New York Edison Company is co-operating with artistic organizations against excessive advertising by the electric sign method in certain localities. In deference to the wishes of such an organization the company has refrained from soliciting sign customers on a particular avenue and has as a result secured the co-operation of the society in other matters. The speaker favored rigid ordinance.

Mr. W. A. Johnson, Pittsburgh, said that his company had received many compliments from influential business men on account of the illumination of the streets by electric signs. About 75,000 4-c.p. tungsten lamps are in service. He criticised the custom of putting small signs in front of large ones, and urged the importance of inspection and careful installation.

In closing, Mr. Callahan said that a rigid ordinance provides the best plan of action. He also favored the use of a flat rate on account of its benefit in securing long-hour service.

ELECTRIC POWER DATA.

The report of the power committee, Mr. E. W. Lloyd, of the Commonwealth Edison Company, Chicago, chairman, consists very largely of tabulations of electric power data, which are of high value owing to their great completeness and authoritative character. One table, occupying twenty-four pages, consists of data collected from central-station companies relating to industrial installations of every class in which electric power is employed. The heads under which the data are given are as follows: Group or individual drive, number of motors, horse-power installed, running hours of factory per week, maximum demand in kilowatts, kw-hours consumed per annum. The second section, which occupies twenty pages, gives the horse-power required to drive more than 800 machines, covering almost every industrial use of machinery. These latter data are an addition to and not a duplication of similar data published in the N. E. L. A. handbook.

A final section gives information as to the power required for the making of artificial ice. The report states that it is safe to say that, under average conditions, using reasonably efficient apparatus, the consumption of electric power in ice-making should not exceed 60 kw-hours per ton, and the result might be accomplished at not more than 50 kw-hours. The data secured indicate that the annual load-factor of the ice auxiliary in a latitude above that of New York is about 65 per cent, and that the maximum demand per ton capacity, where the machinery is of 75 tons capacity or greater, is about 2.3 kw per ton, or, in other words, the maximum demand of a 100-ton plant would be about 230 kw, which includes the power for operating compressors, all auxiliary apparatus and electric lights for the plant.

DISCUSSION.

Mr. C. A. Graves, Brooklyn, said that he hoped that in future the responses to letters sent out would be more liberal. Information received from only one or two installations tends to create a lack of confidence. It has been his experience that many men whose work had been confined to motor service do not realize the essential information that they should have. Inquiries must be of a detailed character.

Mr. Dell Plain, Syracuse, cited the difficulty of tabulating the horse-power requirements of different machines, on account of the variation in conditions in individual cases. In Syracuse a graphic wattmeter test is made for every motor installation. The peculiar feature of this instrument is a variable speed in the paper feed, running from 3 inches per hour to 12 inches per minute. In addition to this record, full data are marked on the chart or on an accompanying card. In dealing with air-compressors, for example, it is necessary to know the pressure requirements, the speed, and the speed of the guiding fly-wheel. Great difficulty has been found in securing the horse-power data of blowers. The speaker did not know of any particular class of machine giving so much trouble as air-handling apparatus. The lack of authentic information regarding steam heating was also brought out by Mr. Dell Plain.

Mr. H. J. Gille, of Minneapolis, Minn., suggested that in future work the committee endeavor to ascertain the approximate number of kw-hours consumed per unit of manufactured product.

Mr. R. L. Lloyd, of Philadelphia, Pa., commenting on the refrigeration returns embodied in the report, pointed to the lesser energy consumption of the automatic machines due to their better regulation.

THE FUNCTIONS OF A SALES DEPARTMENT.

The report of the committee on the functions of a sales department, Mr. T. I. Jones, of the Brooklyn Edison Company, chairman, treats the organization of a sales department in great detail under four heads, namely: General organization of the selling force and the duties naturally pertaining to it; principal reports to be made by the sales department as a whole by its bureaus and by the salesmen; credit as it affects the getting and retaining of business; the compensation of salesmen. The selling-force organization is treated under the heads of advertising bureau, new-installation bureau, appliance bureau and power-engineering bureau. Under sales department the matter of reports is discussed in detail, and forms of reports are reproduced. Compensation of salesmen is discussed under the heads of straight salary, small salary and commission and straight commission. An appendix gives a schedule for solicitors' commissions as used by the Commonwealth Edison Company of Chicago, which has an added interest on account of enumerations in detail of the various classes of electrical business. A schedule is also given of the Denver system of compensation based upon salary and commission.

DISCUSSION

Mr. B. W. Mendenhall, Salt Lake City, favored solicitors' reports expressed directly in terms of watts and kilowatts instead of 16-c.p. equivalents, and Mr. William H. Gardner, Lincoln, Neb., took the same ground, also emphasizing his opinion that comparisons of results between different cities should not be made on the basis of absolute figures only, but should take into account the local conditions. It had been his experience that the plan of making a prospective customer put down a deposit before being connected with the company's service is a policy which tends to throttle sales and discourages the growth of new installation. Business can be properly handled as a rule on the strength of references to or from the tradesmen with whom the new consumer deals.

The payment of straight salary to solicitors was advocated by Mr. S. M. Kennedy, Los Angeles, except in connection with the sale of domestic electric appliances, in which instance a combined salary and commission was divided. Mr. C. Duffy, Milwaukee, favored the use of a kilowatt designation. In his company a daily estimate of the yearly revenue per kilowatt is submitted by the individual salesman. He also favored solicitors' commissions, uniform reports and terms, especially advocating the use of the words "sales department," 'salesmen," rather than "commercial department" or "solicitors." Mr. Burnett favored commissions for salesmen.

Mr. E. W. Lloyd, Chicago, said that his company could not afford to eliminate the commission, which is particularly well adapted to stimulate the growth of business through the enterprise of the employee. Mr. C. A. Littlefield, New York, concurred with Mr. Gardner regarding the inadvisability of making snap judgments upon surface figures. Mr. J. D. Israel, Philadelphia, believed that the deposit is an incidental necessary in dealing with all classes of people. It is as important to hold business once gained as to secure a new revenue.

Mr. Jones closed the discussion by a vigorous speech emphasizing the value of the 50-watt equivalent as a satisfactory unit of comparison. He pointed out the advisability of paying good salaries to few men rather than small salaries to many, and urged the importance of encouraging promotion from within the ranks. He did not agree with the other

speakers concerning the interpretation of comparative figures, urging that human nature is the same everywhere and that figures are the only means of comparing results in anything but a fragmentary way. He felt that giving a customer a prompt connection after he signs a contract is the most important question confronting the commercial department of a modern lighting company.

RATES FOR DIFFERENT CLASSES OF SERVICE.

In a paper entitled "Some Reasons for Difference in Price for Different Services" Mr. Norman T. Wilcox, of the Lowell (Mass.) Electric Light Corporation, gives the result of an analysis of various classes of electrical service in towns of from 5000 to 100,000 inhabitants. In dealing with the data an average diversity factor of 2 was assumed as practically correct between the transformer and generating station; a diversity factor of 1.5 was assumed for the small customer on a single-phase service, and 1.2 for the large motor customer. It was found that the total annual investment per kilowatt of generator for small residences was $350 to $375, with an annual supply of 800 kw-hours to 1000 kw-hours per kilowatt of generator capacity; for commercial work (50 kw), $225, with 1500 kw-hours per annum per kilowatt of generator; for single-phase (1-kw motor), $285 to $290, with 3000 kw-hours or more per annum per kilowatt of generator rating; for three-phase (1000 kw), $175, with 3000 kw-hours or more per kilowatt per annum, though this figure may fall to $100 or even less per kilowatt. Some authorities give the cost of residence-lighting investment as high as $440 per kilowatt of generator rating, so that while in residence service with an investment of $350 to $440 only 800 kw-hours to 1000 kw-hours per kilowatt of generator are sold annually, with large motor service, involving a total investment of $175 down to $100 or less, 3000 kw-hours, or possibly 6000 kw-hours or 7000 kw-hours, per annum are sold for each kilowatt of generator rating. For residence work often 2 kw-hours must be generated for every kw-hour sold, while, on the other hand, only 1.1 kw-hours are generally required for large motor use. The attendant losses are much less for the larger customer, so that with a 50-kw customer the complete investment per unit may be not more than one-half or two-thirds that required for a small customer. In this case again the larger customer so uses the station equipment as to enable the service company to sell him possibly 1500 kw-hours per annum instead of the 800 kw-hours to 1000 kw-hours sold to the residence customer, thus distributing the total cost over more units with resulting lower kw-hour rate.

RESIDENCE BUSINESS.

The report of the committee on residence business, Mr. Clare N. Stannard, of the Denver Gas & Electric Company, chairman, considers the subject under the heads of desirability of residence business, means of getting such business and the results that had been obtained in securing residence lighting. As to the first question the reply is that there is no doubt that residence business is desirable, the point to be decided being how desirable. As the result of an inquiry among member companies the consensus of opinion is practically unanimous that apartment business is very desirable. As to the other classes, whether it is desirable depends upon the saturation of the lines in the residence districts and whether the construction is overhead or underground. Nevertheless, the educational or advertising value is in many cases sufficient to warrant taking on residence business regardless of whether it is profitable or not. For suburban territory the advantages between street overhead, sidewalk and backyard construction of distribution lines is in favor of the latter as being on the whole least expensive. It is stated the greatest difference of opinion exists as to the advisability of companies rendering any financial assistance to a prospective customer in installing or equipping his installation. The practice varies from free wiring, with a nominal charge for fixtures, to no assistance whatever. Competitive companies usually render some assistance to the customer. As to the advisability of companies going into the fixture and wiring business, the great weight of opinion is toward the protection of the contractor by employing him as the agent of the company to do the work, the company paying the contractor and collecting from the customer.

A valuable feature of the report consists of a number of plans for wiring relating to two model houses, one of the bungalow type, costing $3,000 complete, and the other of two stories and basement, costing $8,000 complete. All circuits and outlets are indicated on the plans, and schedules given of the material required and of all appliances that it will be desirable to have the customer install. As to prepayment meters, it is stated that the answers received from member companies show that this device has not yet been developed to such a state as would warrant its widespread installation. Where installed the tendency is to require a guarantee of at least $1 per month from the customer. Opinion, however, is against its use in residences. An inquiry among the member companies showed that the requirements for extensions vary from a minimum that the revenues shall show over 10 per cent of the overhead charges after the actual cost of delivering the energy shall have been paid to a maximum that the revenue for the first year shall equal the whole cost of the extension. The opinion seemed pretty well established that where the revenue for the first year promises to equal 70 per cent of the cost of the extension the latter should be run free of cost to the consumer. Where the estimated revenue is less than this it is a good policy to return to the customer a part of the cost, this being credited to him as a certain percentage of his monthly bills.

In conclusion, the committee states that the results reported in securing residence business have been most encouraging, showing increases of from 20 per cent to 40 per cent in residence business over the previous year. As to the revenue secured there is a great difference, the amount varying from $18 to $40 per year, a fair average being $25 per customer. The figure for kilowatts connected varies from $18 to $22, the average being $21 per annum.

DISCUSSION.

In the discussion following the reading of the report Mr. Douglas Burnett, of Baltimore, questioned the advisability of charging the customer for the service wires from the building to the pole lines where competitive electric, independent gas and electric or a combination gas and electric company exists. He felt that in a combination company the matter should be decided on its merits and that there should be no service charge to the consumer.

Mr. A. S. Ives, of Poughkeepsie, N. Y., drew attention to the fact that in making extensions, plant investment as well as line investment should be considered and that the revenue should be about 10 per cent over the actual cost of the energy, divided between interest and investment charges.

Mr. H. J. Gille, of Minneapolis, Minn., felt that residence business was most desirable and that oftentimes central station companies forget that they owe obligations to the public. From an analysis of 4000 residences in his city, flats consumed on an average of 23.7 kw-hours per month during the year and residences 26.5 kw-hours.

Mr. L. H. Scherck, of Newburgh, N. Y., wished to know if the committee had obtained any information on controlled systems, and Mr. E. F. McCabe, of Lewistown, Pa., vouchsafed the information that despite competition from natural gas selling at 28 cents per thousand cubic feet his company had by means of the excess indicator secured in three months five times as many residence customers at it did in the whole year previous.

Mr. P. H. Kemble, of Toronto, Ont., pointed out serious defects in the present method employed by the association in obtaining information of value. He had come to the conclusion that circular letters were of little or no avail and that if best results were desired personal interviews should obtain.

Mr. R. M. Searle, of Rochester, N. Y., enlivened the discussion with some experiences from Rochester. While regretting the fact that his company was somewhat backward in canvassing for residence business, he nevertheless showed it possessed a lively appreciation of its obligations to the public and to the community.

LETTERS ON PRACTICAL SUBJECTS

ADJUSTING INTERPOLE FIELDS OF GENERATOR.

The following method of adjusting the interpole fields of generators may be of interest to those operating this class of apparatus. First set the brushes on no load neutral by taking voltage readings with the armature rotating clockwise and then counter-clockwise. The brushes will be on the neutral point when the two voltage readings are the same. Then throw the rated load on the generator and adjust the interpole field strength until the neutral point is brought back to the no-load neutral position, this being determined by taking voltage readings with the generator rotating in both directions. The interpole field strength is now properly adjusted for all loads up to the saturation of the interpoles and a permanent shunt of german silver should be made up for the interpole field winding.

Pittsburgh, Pa. H. M. Nichols.

BLUEPRINTING FROM TYPEWRITTEN FIGURES.

To obtain strong, clear and contrasting blueprints from typewritten letters and figures a sheet of carbon copy paper, reversed, should be placed behind the original sheet, so that the characters will be offset on the back of the page as well as printed on its front. This double printing prevents the diffusion of the light through the paper, which otherwise causes the dull and ragged appearance usually obtained when attempts are made to blueprint typewritten figures. A little trouble taken to place the reversed carbon behind the paper or cloth original will result in clear, distinct figures, as sharp and often better formed than hand-lettering.

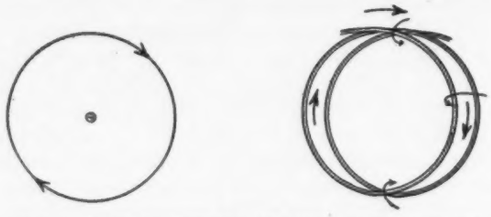
Chicago, Ill. L. S. Dennis.

THE CORKSCREW VS. FLEMING'S RULE FOR RELATION BETWEEN DIRECTION OF CURRENT AND FLUX.

There is a definite relationship in the direction of the current through a conductor and the flux which this current tends to set up. This interrelation is absolutely fixed and unchangeable, no matter whether the conductor be a wire in a motor or generator or a disk rotating between the poles of a permanent magnet. There are two methods of determining the direction of the magnetic flux when the current polarity is known and vice versa, namely, Ampere's rule, the first to be set forth, and the corkscrew rule. Both are well known and their use seems to be fairly equally divided, but the latter appears to be by far the better of the two. To apply Ampere's rule requires a distinct effort of the memory; thus, it is necessary to know whether to swim with or against the current, whether to have face or back to the needle, and, hardest of all to remember, whether the needle will point toward the right or the left hand. On the contrary, anyone who is familiar with a corkscrew will have nothing with which to burden his memory. The latter rule states that if current is flowing along a corkscrew the lines of flux go around it, as though traveling along the helix; or, equally true, if current is flowing circumferentially, as if in the helix, the lines of force advance axially in the direction in which a corkscrew would go.

In Fig. 1 we have a wire in which the current is going into the paper (shown by the tail of the arrow), and consequently the flux lines must go around to the right, as shown. If the current were coming out of the paper it would be the unscrewing action, to the left. Fig. 2 shows a coil in which the current is supposed to be going around right-handed. This motion of a corkscrew would make it go in, and that is precisely what would happen to a north pole placed in the coil—that is, the distant end of the helix is of north polarity. If the current had the unscrewing motion, the lines would come out. Thus it is seen that it is even unnecessary to remember whether by this convention it is the flux which rotates and the current which progresses, or the reverse; they are perfectly interchangeable in this rule.

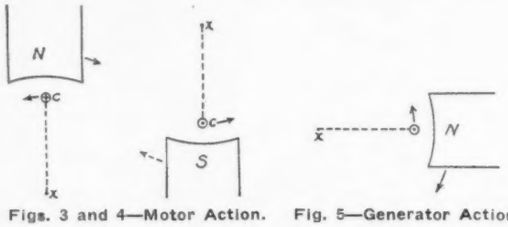
The above rule is widely known, and is so simple and so easily applied that it is in wide use. When we come to dynamo-electric machinery, however, conditions are quite different.



Figs. 1 and 2—Relation Between Direction of Current and Flux.

Here the only rule of current direction at all well known is that due to Fleming, and the person who is not using it frequently will find that this rule cannot be accurately remembered. For one must recall which of three fingers represents respectively the direction of motion, flux or current; and then the left hand must be used in some instances and the right hand in others.

But if our corkscrew rule really expresses a fundamental relationship, as was stated, it ought to be able to solve all such cases, and, indeed, this it will do. In Fig. 3 suppose c is a conductor carrying current into the paper, as is indicated by the cross. If this conductor is fixed, and N is a north pole free to rotate around the axis x, what will be the direction of its motion? A corkscrew going in would turn to the right, and so would N, as the arrow indicates. Now let us fix N and leave a free to rotate about the same axis; then, since the relative motion of the two must be the same, the conductor



Figs. 3 and 4—Motor Action. Fig. 5—Generator Action.

will move to the left. This principle will solve all motor problems. Take the case of Fig. 4; here we have a fixed south pole S and an axis x about which the conductor c is free to rotate. The current is coming out of the paper, and a corkscrew would turn as shown. A south pole, which travels not with, but against, the lines of magnetic flux, would go clockwise around c (dotted arrow); and to preserve the relative motion the conductor moves to the right.

In the case of a generator it will be remembered that the

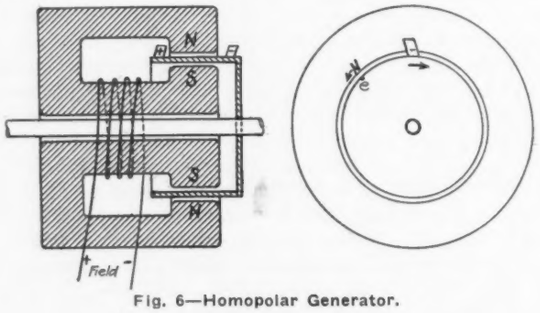


Fig. 6—Homopolar Generator.

magnetic effect of the armature current tends to oppose the motion. Thus, in Fig. 5 we have a conductor rotating upward, as shown. That means that the N pole is turning clockwise about the current; opposing this would be unscrewing the corkscrew, which would move outward, as indicated by the arrow tip. The application of the rule to other cases is equally simple.

This method of solution is especially good for unusual

problems. Let us investigate the direction of the current in the homopolar or acyclic generator represented in Fig. 6. Here we have a field winding in which the current, as seen from the right, is circulating in the clockwise direction, thus causing the lines of force to go in toward the left. Referring to the end view, take an element of the cylinder *e* which is rotating clockwise, giving the *N* pole a relative counterclockwise motion. As this is a generator, the current tends to oppose this motion,

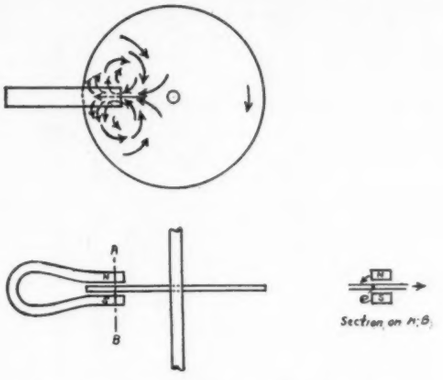


Fig. 7—Eddy Currents in Rotating Disk.

turning right-handed, and thus going in. This is, therefore, the negative end, as shown.

The case of eddy currents in a brake disk, Fig. 7, is similarly solved. Referring to the section on *A-B*, we have relative rotation of the *N* pole about the element *e* to the left. The current opposing this would send the lines of flux around to the right, or the corkscrew would go in. The path of the eddy currents is shown.

Wilkinsburg, Pa. HORACE V. S. TAYLOR.

reverse its direction of rotation. By moving the brushes from *a* to *c* the N_2 pole of the armature is moved through a corresponding angle, which brings it nearer the N_1 than the S_1 pole-pieces, and since the action of the armature N_2 pole is to induce an unlike, or S_3, pole in pole-piece N_1, also to induce an unlike pole S_2 in S_1 the attraction is greater toward the N_1 pole, which has now become a south pole, consequently

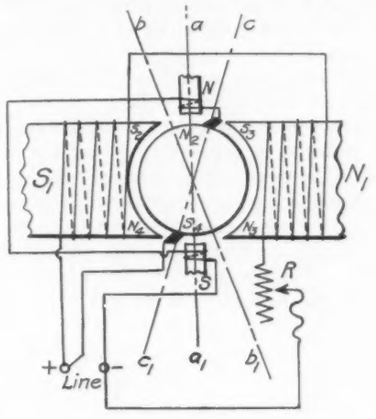


Diagram of Interpole Motor.

the direction of rotation will be reversed. The action of the interpoles in the above-cited experiments was only to add torque to the motor in either direction of rotation. It was necessary in all of the above tests to have sufficient resistance in the armature circuit to keep the current within the limits of the maximum allowed for the line and machine. Actual experiments have been made which prove the above statements to be true.

Ft. Monroe, Va. WILLIAM M. CLINE.

ACTION OF INTERPOLE MOTORS.

Referring to the article by Mr. R. W. Abraham in the first issue for April exception is taken to that part of his statement relative to position of brushes of an interpole motor necessary to cause the motor to reverse its direction of rotation if the main field should become so weak that it would be demagnetized by the field of the armature and a field set up in the field poles in an opposite direction. It is not understood just how the armature field could, with a forward lead of the brushes, demagnetize the main field and set up a field in the opposite direction. By an examination of the cut it will be found that if the brushes are placed on the line *a*, a_1, and the field excitation reduced to zero the armature will stop, since the attractive force exerted at this instant is the result of the action of the armature field on the pole-pieces—that is, the armature field N_2 induces a magnetic field in the pole tips nearest to it of unlike sign S_2S_3, which would be equal and opposite in direction, thereby preventing rotation. If the brushes are moved ahead (in the direction of rotation) on the line *b*, b_1 and the exciting current reduced to zero or to a point at which the armature field would become stronger than the main field, demagnetize it and induce a field in the pole-pieces, the armature would continue to rotate in the same direction, provided the load was very small, and would not reverse its direction of rotation as stated in the article referred to above. By moving the brushes ahead the N_2 pole of the armature is moved ahead through the same angle, thereby bringing it nearer to the S_1 than the N_1 pole-pieces, which will cause the attraction due to the fields induced in the pole tips S_2, S_3 by the armature field toward the S_1 to be greater than toward the N_1 pole-pieces; this will result in the rotation of the armature in the same direction as when the field was excited. But should the brushes be set back (against rotation) on the line *c*, c_1 and the field excitation be reduced until the field of the armature was the stronger, if the armature was then carrying a very small load, it would

DRYING OUT ELECTRICAL APPARATUS.

For several years past a number of dredges have been employed deepening and extending the Los Angeles Harbor at Long Beach and San Pedro, Cal. As the material to be removed is sand and silt and fairly soft, these dredges are for the most part of the pump type, and all machinery is electrically driven, the energy being supplied from the lines of the Southern California Edison Company, which cover that district. A cutter blade similar to a propeller is driven by a motor and forced against the ground to be removed, while just back of this cutter is the suction pipe of a large centrifugal pump. It is readily seen that the sand, etc., loosened by the cutter will be picked up by the stream of water flowing into the pump and from there it discharges through a pipe carried on pontoons to the land to be built up for warehouse and factory sites; this area of "made" land being first outlined by a dike thrown up by a clam-shell dredge so that the water runs off, leaving the solid matter from the harbor bottom behind. Some of the dredges are quite large and expensive, and in addition to the machinery mentioned above carry a number of motors for their control and guidance while working. Not long ago a valve in the discharge pipe inside the hull of one of them gave way and the water in the discharge pipe, together with that thrown by the pump before it could be shut down, was sufficient to sink the dredge, and it remained on the bottom about ten days before being raised, towed to the dock and pumped out. The power company was requested to take charge of the work of drying out the electrical equipment and getting it back in service, and it was a sorry, bedraggled looking lot of apparatus that was found upon arrival. The dredge is supplied with energy at 2200 volts through a submarine cable and large motors are wound for this voltage, while a pair of 37½-kw transformers step it down to 440 volts and 220 volts for the smaller motors, lamps, etc. The pump motor was a 600-kw synchronous machine, so that a variable-speed starting motor and an exciter were re-

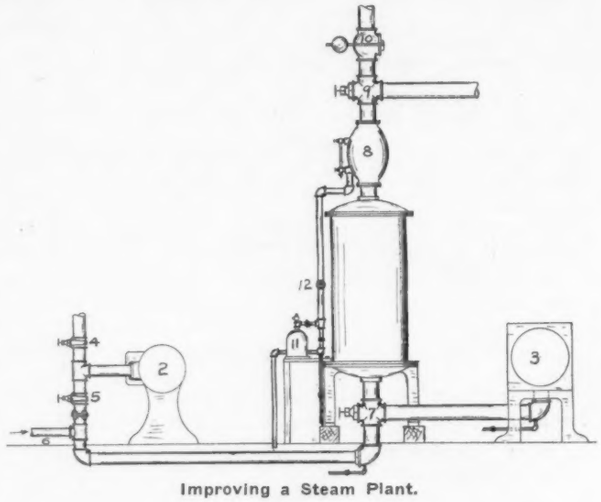
quired. As ten days' immersion in sea water is rather rough treatment for 2200-volt apparatus the method used in getting the machinery back in running condition may be of interest. First, the whole lot was gone over with a hose and stream of fresh water to wash off the sand and silt with which the machines were covered; then the hose was connected with a boiler on the dock and water nearly boiling hot was used to wash out as much of the salt as possible. Next, the machines were covered with a tarpaulin one at a time and hot air from an electric heater was forced through them by means of fans until it was thought they would stand enough voltage to give a little over full-load current with the rotors blocked. The machines were run this way for several days and then the rotors were allowed to revolve, as it was found that the fanning action of the rotor was as good as heat in drying out the windings. As soon as one motor was in shape to run it was belted to the synchronous machine and this was kept running with the field coils short-circuited and 440 volts on the armature windings. This large machine had been reconnected from 6600 volts and the connections taped with varnished muslin and friction tape. It was found that the salt had worked in here and could not be washed out, so that all this tape was taken off and new put on after the drying was completed. To show the penetration of the salt water it may be said that with 400 volts on this machine it was dangerous to touch any of the coils or rubber-covered cables leading to it while standing on the steel hull of the dredge. The synchronous machine was run this way for about ten days, and then the voltage was built up on it to 2800 and it was pronounced sound. The two transformers were short-circuited on the secondary side and 110 volts applied to the primary for a time and then the low-voltage motors were connected to the secondary and the primary voltage raised from day to day until they were finally put on the line at normal voltage. Of the entire equipment only one motor had to be rewound, this being a 440-volt, variable-speed machine having partially inclosed slots, so that the coils were not protected by the insulation as was the case with the form-wound coils placed in open slots. Some of the low-voltage motors had this closed slot and yet were saved, but all the big machines had the open slot and it would seem that this is much to be preferred on machines subject to such severe treatment as this, for instance, where the salt fog and spray are always more or less present. The direct-current exciter ran satisfactorily for a while, but the heat seemed to drive the moisture in the field coils to the surface, where the tape and insulation prevented its escape, so that they were also rewound. They could possibly have been saved, but as time was a great factor it was considered cheaper to rewind them. With the above two exceptions and the several switchboard instruments the entire electrical equipment was saved, even to the watt-hour meter, which checked up closely after drying out, cleaning and replacing a rusted shaft. The total rating of the apparatus was approximately 1200 hp and the cost of drying out but a small fraction of what the replacement or rewinding cost would have been. The dredge has now been in regular service something over a month without showing a sign of trouble, which speaks well for the methods of drying used, as well as for the electrical machinery which will withstand such abuse and live to tell the tale.

Los Angeles, Cal. C. A. Howell.

IMPROVING A STEAM PLANT.

A certain steam plant had been operated under conditions which will be understood by examining the illustration in connection with the following description. A high-speed engine of about 25 hp is shown at 2. Formerly it exhausted into a feed-water heater, and from there the steam passed freely into the atmosphere. A moderate-speed engine of about 60 hp is illustrated at 3. The exhaust steam from this engine passed into the large heater and then was conducted through the roof into the outer air. There was not a valve in either of these pipes. A steam-driven air compressor and two direct-acting boiler-feed pumps also exhausted through separate pipes which extended above the roof. Live steam was used for heating the shop, as the engineer who designed this plant did not believe that exhaust steam was valuable for any purpose.

The method of operation was as follows: The small engine 2 was used every day, and a suitable steam pump forced water through the heater and supplied the boiler for this service. The larger engine 3 was required three or four days per week. When it was used another steam pump was started to supply



Improving a Steam Plant.

the additional water required. It forced water through the large heater shown by means of a separate system of piping. This method is not only wasteful, but if anything happened to one pump or the connecting pipes it was not possible to use the other to supply the deficiency, as both were separate.

It was decided to remodel this part of the plant, and the following changes were made. The small heater was discarded and a free-exhaust pipe carried out through the roof. This is for use in an emergency which makes it necessary to shut off exhaust steam from the other pipes shown in the illustration. A gate valve 4 was provided, but it is closed under ordinary working conditions. Another gate valve 5 is open allowing steam from this engine to pass to the large heater, as indicated by the arrow. The inlet 6 receives exhaust steam from the pumps and air compressor.

The larger engine 3 exhausts through the cross-valve 7 into the heater, and by this arrangement all of the exhaust steam is utilized instead of blowing into the air. Under former conditions the roof was partly covered with grease, caused by exhausting the remains of cylinder oil from the engines and pumps, but this is all taken out by the separator 8 and sent to the sewer. This location of separator above the heater is criticised by some engineers, but the reason for it is as follows: If located below the heater it would leave only pure exhaust steam for use in heating the feed water, which process always produces more or less water resulting from the condensation of steam, which can be returned to the boiler, thus saving water and heat. With the arrangement shown this water is wasted, but the main object is to remove the harmful cylinder oil, preventing it from going into the boiler and this is done more effectually when drops of water are mingled with the steam. The heater supplies these drops and the desired result is secured. In this particular case the separator could not be placed below the heater as there is no cellar under the engine-room.

The cross-valve 7 is closed when 3 is shut down in order to prevent steam from backing up into the cylinder and causing the parts to rust and corrode. The drip pipe in the ell under this valve is a necessary feature, as the exhaust pipe must be kept free from water. Another drip pipe is shown under 3, which is also necessary for use when 7 is closed.

A cross-valve at 9 was included in the original plans to shut steam off from the heating system, but it could not be secured promptly as it was not carried in stock by the manufacturers, hence a tee was substituted and a globe valve put in the pipe extending toward the right hand. The back-pressure valve 10 is opened when steam is not wanted for useful purposes, but is closed when the shop requires heat. The small trap 11 allows all water and oil to go into the sewer, but prevents waste of steam. Equally good results cannot be secured by use of a valve in the pipe, as shown at 12, because it must always be nearly closed, whereas the trap opens wide when a large quantity of water comes into it and closes automatically if the steam is nearly dry. With the trap in use 12 should always be wide open.

This exhaust steam which was wasted under former conditions is sufficient to heat the shop in ordinary cold weather and only a small quantity of live steam is required when the thermometer indicates zero temperature.

The water resulting from condensation of steam in heating the shop goes into a receiver and is automatically returned to the boiler. This pump is large enough to supply water for both engines, and can be run slow enough for one only. This improvement not only saves a large part of former bills for water, but reduces the consumption of coal about 25 per cent, thus proving a very good investment.

New Haven, Conn. W. H. WAKEMAN.

FOUNDATIONS FOR ELECTRICAL MACHINES.

After reviewing and carefully digesting the several able articles and letters which have recently appeared regarding machinery foundation, it seems as if foundations were often designed and constructed with a very indefinite realization of what a foundation is to accomplish. Briefly stated, the office of a machine foundation is threefold: First, to support the machine by distributing its weight over sufficient soil to carry it; secondly, to absorb vibrations of the running machine, and, third, to withstand any tendency to topple sideways through pull of belts or settling of any local soft spot in the soil beneath the foundation. These three points are little regarded by the majority of engineers when building a foundation for electrical or other machinery. The usual procedure is to locate the top of the foundation where convenience demands and then locate the bottom wherever solid soil may be found. The two planes thus selected are filled in between with solid masonry or concrete with no regard to the mass of masonry actually required to give stability and smooth running to the machine thus supported. Usually, even where there is solid earth close to the plane of the foundation top, an excavation will be made from 4 ft. to 8 ft. deep and a mass of masonry or concrete placed therein. It is to induce constructors to study the actual requirements of machines as regards foundations, with a view of saving some material now evidently wasted in foundations, that these lines are written. That there can be a saving made in most foundations is the belief of the writer, and engineers and constructors are requested to study and carry out the following considerations before putting yards and yards of good building material beneath comparatively small machines for foundation purposes. The first point to be considered is the weight which a given foundation will support when placed upon ordinary soil. The engineers carefully calculate the footings of building walls to carry from 1½ tons to 6 tons per square foot, according as the soil ranges between soft, wet sand and hardpan. In the following deductions let it be assumed that the soil will safely carry a vibrating machinery load of 1 ton per square foot of area and that the foundation material weighs 150 lb. to the cubic foot. Right here is a suggestive point against high or deep foundations. Without footings a wall or pier will barely sustain its own weight on 1-ton soil when 13 ft. 4 in. high. Of course, footings may be extended to enable almost any load to be carried, but the fact that a foundation 13 ft. or 14 ft. high is the limit for a machine foundation on poor soil may set a train of thought going in a direction new to some constructors. Next comes the size of foundation necessary to support a machine (and its foundation) upon the soil. Assume that a certain generator weighs 5000 lb. and occupies a floor space 4 ft. x 7 ft., or 28 sq. ft., to carry a load of 5000 lb., which is about 185 lb. to the square foot. Of what use is a foundation 5 ft. or 6 ft. deep under this machine, with footings extending on all sides from 1 ft. to 2 ft. beyond the foundation? Such an arrangement would give 54 sq. ft. of soil-bearing surface and the machine load would be only about 92 lb. per square foot. The 4-ft. x 7-ft. foundation need be only deep enough to hold itself together or to absorb the vibrations of the running machine. In case of a steam engine this amounts to something, but in case of an electric generator vibration drops out of the question entirely, hence the foundation has nothing to do except to keep the generator out of the dirt. But the pull of the belt is something to be directly opposed by the foundation. There is a 10-in. belt and it is supposedly put on the pulley with a strain of 40 lb. to the inch of width. This is 400 lb. for the 10 in. of belt width, and, allowing an equal strain in the other fold of the belt, there will be the modest pull of 800 lb. on the generator belt. When the machine is running it is evident that the tension slacks in one fold of the belt and increases in the other fold. This may increase until the excess tension in the working fold is 60 lb. and the tension of the slack fold is 20 lb. This gives the working pull 40 lb. to the inch of belt width as before. Belts work better and last longer when thus tensioned than they do when the working strain is made 88 lb. per inch, as given in some belt catalogs. But the slight sidewise belt pull of 800 lb. is nothing for a 5000-lb. generator. That strain could never move it in the least, therefore no attention need be given to the belt pull or resistance thereto. The next point to be considered is the side strain of the machine due to the columnar effect of a load upon a foundation of a given height. It may be stated that until the height of a foundation exceeds its least thickness, width or length there can be no columnar effect and the calculations are the same as if the foundation were a cube. Therefore, until the height of any foundation exceeds either the width or length no attention need be given to the columnar effect, which is that of a weight supported by a post or column. In every point considered above it has been shown that the less depth given to a machine foundation the better. Therefore, should great depth be required in order to support the machine at a considerable distance above bedrock or firm soil, it will be better to put in a system of pillars or arches to carry a low, flat foundation to which the machine shall be attached, the posts, columns or arches to be calculated independent of the fact that a machine foundation is to be supported. The calculations should be made exactly as if the arches were to carry a certain load in an architectural structure. The last point to be considered is the use of the foundation to lessen vibrations of a machine. In electric generators vibration is, as stated, not a factor in the problem. In steam engines and other reciprocating machines foundation mass is sometimes made use of to lessen vibrations, but it is not a mechanical method. The place to lessen or cure vibration is in the vibrating machine itself, not by adding concrete masonry to the vibrating mass. When it is considered necessary to use a foundation to keep a machine in the home county, then the owner should look around for a machine which "will stand without hitching." Don't add to the wear caused by vibration by adding a still greater load to the efforts of natural laws to follow the line of least resistance. In the case of heavy hammers or similar machinery the mass of foundation should bear a direct ratio to the permissible movement caused by vibration. For instance, should a 4000-lb. machine be found to vibrate ⅛ in. the addition of another 4000 lb. in the shape of a firmly attached foundation will reduce the vibration to 1/16 in. Then 8000 lb. more in the foundation will reduce the vibration to 1/32 in., and so on. But as it is impossible to attach the foundation mass to the center of gravity of the machine, the result of the added weight in a horizontal reciprocating machine will be that the machine will rock to and fro in an arc, the center of which is a point in the bottom of the foundation.

South Bend, Ind. JAMES F. HOBART.

QUESTIONS AND ANSWERS

I have a 2-hp, 60-cycle, 110-volt, self-starting, single-phase motor operating at 1200 r.p.m. At starting the motor pulls 30 amp, and when the brushes are released the motor takes from 40 amp. to 45 amp. The motor was recently rewound and it may be that the work was not properly done. J. A. R.

Assuming that you have properly rewound the motor, it is very probable that the brushes do not occupy the correct position along the commutator. A very slight movement of the brushes makes a great difference in the current taken by the machine, both at starting and when the brush mechanism releases. However, it has no effect upon the running speed or the current taken by the machine when operating at full speed.

Kindly inform me what the voltage and other data on the energy supply of the principal cities of this country are, both for light and railway service. C. A. G.

Both alternating and direct current and many different voltages are used in this country. However, the standard emf for lighting circuits is 110 volts. In large cities the direct-current system with 110 volts at lamps is commonly employed. In the smaller towns 60-cycle alternating current is usually employed, with 110 volts at the lamps. When motors are used on the same circuits with the lamps the arrangement is usually such as to provide 220 volts for the motors. The standard electric railway system of this country employs 600-volt direct current. There are in existence a few 1200-volt direct-current railway systems, and also a few alternating-current railway systems with emfs ranging from 3000 volts to 11,000 volts.

Is there any metal or substance which varies its electrical resistance in accordance with the amount of light it receives? That is, is there a substance that will allow more electricity to pass through it in sunlight than in shade? Is the change instantaneous in effect or due to the added heat? H. D. W.

Of the substances the electrical resistance of which is varied according to light falling thereupon the one best known and most commonly used is selenium. Selenium in pencils for making cells may be procured from Eimer & Amend, Third Avenue and Eighteenth Street, New York. We do not know of any firm that keeps the cells in stock, but doubtless Queen & Company, Philadelphia, would accept an order for importation.

We have recently changed our system from single-phase to three-phase. Our transformers are connected up to feed a three-wire secondary, 110-220-volt lighting load, with the neutral grounded. If the transformers are connected so as to balance the load on each phase, the neutrals being grounded, will it cause a cross-current to flow from one transformer to another, on a different phase through the grounded neutral? Can I connect three transformers in delta, giving 220-volt, three-phase energy for motor circuit work, and then use a fourth wire connected to the neutral of each transformer, so as to obtain 110-volt energy between that wire and any of the other three? C. H. C.

The method of employing common neutrals for the three transformers of a delta-connected three-phase system will prove disastrous. When the transformers are connected in delta there exists between the middle points of the different transformers an emf 86.6 per cent as large as the emf between the terminals of each individual transformer. If these so-called neutral points are joined to a common wire this emf will produce an enormous current in the transformer circuits. It is permissible to connect the middle point of any one transformer to the ground, but when this is done the middle point of the other delta-connected transformers should not be so connected. The only permissible way of using a common neutral when employing three-wire distributing circuits from a three-phase source is to use separate main leads from each transformer circuit. That is to say, any one point of the secondary of any one transformer can be connected to any one point of the secondary of another transformer, but after one point is connected it is not permissible to connect any other point. If the middle points of the three transformers are jointed together, then the terminal points must not be joined, and six separate leads must be taken from the three transformers.

Is it proper to refer to well-known instrument transformers used on switchboards as current transformers and potential transformers? W. F.

While the terms would be understood by operating men they are not correct. What is commonly referred to as a current transformer is a series transformer, and a potential transformer is a shunt transformer. "Series" and "shunt" are preferable to "current" and "potential."

Are there any other services that an electric fan can be made to perform in addition to its usual functions of keeping one cool; keeping frost and vapor from windows; increasing the circulation in a hot-air furnace and increasing the amount of heat liberated from a radiator? K. J. C.

Circulation of air causes rapid evaporation, resulting in cooling and drying and also condensation. Wherever any of these is required an electric fan can be used to advantage. Wherever just a movement of air is desired the electric fan is also applicable. One use for the electric fan not widely known is its ability to keep rooms or areas free from flying insects and pests, such as house flies, mosquitoes, etc. It would be impossible to enumerate all the uses to which an electric fan is put. One so minded could use an electric fan all the year round for different purposes to advantage.

I have read much about the undesirability of residence customers, the argument being that a residence load is unprofitable. We do not find it so, and wonder if ours is an exceptional experience. G. T.

Inasmuch as for years the only business available to central-station companies was and even now is in the majority of places residence business, and since such companies did not then become nor are they now bankrupt, the contention that the load is unprofitable is untenable. The load is not as profitable as business having a greater load-factor, and hence is not in a sense as desirable. We doubt, however, if any company not already possessing an overloaded station would refuse such business.

Given a 100-kw, three-phase, 2300-volt generator, 25.13 amp per phase, what is the formula for obtaining the kw rating? If the ammeters indicate 15 amp per phase does not this signify three-fifths of the total output? Is the hp obtained by calculations on one phase, or are the phases added together and the result multiplied by the number of volts to get the kw? What is a safe number of 54-watt lamps to connect to a 100-kw, 2300-volt, three-phase generator? J. A.

Assuming that you are familiar with the method of calculating loads on single-phase apparatus, it can safely be stated that in dealing with three-phase quantities it is best to reduce the three-phase quantities to single-phase equivalents. On this basis the equivalent single-phase voltage is the value measured between wires on the three-phase system, while the equivalent single-phase current is the value measured in one wire multiplied by a constant equal to about 1.7. Thus if the ammeters indicate 15 amp in each wire the equivalent single-phase current is $15 \times 1.7 = 25.5$ amp. You will note that it differs only slightly from the value stated by you—that is, 5/3 of the indicated current. If, as assumed, a three-phase, 2300-volt generator carries 25.13 amp in each wire, the equivalent single-phase current is equal to about 44 amp. The value of the volt-amperes is $44 \times 2300 = 101.200$. It cannot be stated just what the value of kilowatts would be from the known value of volt-amperes because the latter value must be multiplied by the power-factor in order to obtain the kilowatts. If the power-factor is equal to 1, the kilowatts would be 101, while if the power-factor is 50 per cent the kilowatts would be 50.5. A 100-kw generator could safely feed energy to $100,000 \div 54 = 1852$ lamps, each of which consumes 54 watts.

Central Station
Management, Policies and Commercial Methods

FREE FLATIRON REPAIRS.

The Union Electric Light & Power Company, St. Louis, is advertising in the daily newspapers to announce that it will make repairs on electric flatirons free of cost, provided the irons are obtained from the company. If such an electric iron is not in working condition, it is necessary only to notify the company and the necessary repairs will be made without charge. Furthermore, the company offers to deliver a household-type electric flatiron for thirty days' free trial. If the customer finds the iron satisfactory he is to agree to pay $4.25 for it in five monthly payments, four of which will be $1 each.

A TINY TEXAS CENTRAL STATION.

Mr. C. W. Faulk, of Skidmore, Tex., is installing a 10-kw gasoline-engine-driven generator set which will make central-station lighting service available for a local community of 600 inhabitants. The transmission system into which the 2300-volt alternator delivers its energy comprises a total of about 3 miles of line, which is equipped with several 2-kw transformers for house service. The generator set will be operated nine hours each night, its cost of output at the switchboard being 3 cents per kw-hour at full load, and 5 cents per kw-hour at half load. The customers' service is to be operated on a flat-rate basis—90 cents per month for each 25-watt lamp. Under these conditions Mr. Faulk is assured a net income of several hundred dollars per month, as a number of local citizens have expressed their intention to use the electric light.

FREE CLEANING AND OILING OF CUSTOMERS FANS AT SEASON'S OPENING.

With the opening of the fan season in Louisville, Ky., the Kentucky Electric Company, supplying central-station service in that city, has dispatched a corps of ten men to visit all fan customers, cleaning and oiling their fans free of charge. This free cleaning and oiling service reaches every customer on the company's circuits, including the outlying residences with one or more fans, as well as the large downtown consumers, some of whom have many fans installed. The company takes the precaution to see that all these fans are in good running order at the beginning of the season, finding that this inspection insures the use of the fans all summer long, so that the expense of sending out representatives is well justified. Before starting its men on their rounds, the company addressed a letter to all its customers explaining to them that it proposed to clean and oil the fans gratis and offering to make repairs at cost.

WIRED-HOUSE RATIO AT DALLAS, TEXAS.

With a population of 92,000 in Dallas, Tex., the Dallas Electric Light & Power Company has 12,400 electric customers, of whom at least 8000 are residence users. Excluding the humble homes of Dallas' negro population, it is probable that over 90 per cent of the residences of the city are wired and using electricity, according to Mr. J. C. Woodsome, who, until his appointment as manager of the Tampa (Fla.) Electric Company April 1, was superintendent of the Dallas Electric Light & Power Company. This large ratio of customers to population, which places Dallas among the first cities in the country in this regard, has been in part due to the low rates for service, 9 cents net per kw-hour for residence lighting customers. All wiring is done by contractors, and the demand for central-station service in residence sections has even resulted in the company being importuned to extend its lines to new customers where sometimes such business is not advantageous on account of construction cost.

ELECTRIC RATES AT LOS ANGELES.

The Board of Public Utilities of Los Angeles has fixed the schedule for the sale of electricity for lighting and motor service for the ensuing fiscal year of 1911, these rates to go into effect July 1. In general the electric-lighting rates are reduced, and the present minimum monthly bill of $1 has been abandoned in favor of a monthly service charge of $0.35 per connection, in addition to which the customer is required to pay for the electricity actually registered by his meter. The new schedule decreases the cost per kw-hour for the first 250 kw-hours from 7 cents to 6.5 cents. Consumers using less than 11 kw-hours per month will profit by this change, while those using from 11 kw-hours to 70 kw-hours will be required to pay slightly more than before. Consumers using more than 70 hours will effect a saving from the operation of the new rates. In cases where the consumer is given the choice between direct-current and alternating-current motor service and chooses to use the direct-current supply he will be required to pay 15 per cent above the regular motor service rates specified. Where he is given no choice between direct current and alternating current the rates for both classes of service are the same.

ELECTRIC FANS VERSUS SCREEN DOORS.

A number of electric ceiling fans are being installed over the doorways of business houses in Mobile, Ala., to keep flies from entering the storerooms, the former annoying and uninviting screen doors being meawhile dispensed with. The draft created by the fans effectually prevents flies from passing through the wide-open doorways and also discourages them from alighting on and soiling display windows near by. The use of the fans eliminates the need for the unpleasant screen doors, which, as merchants know, detract from the appearance of their shops and admit flies when opened. One of the first of these outside ceiling fans in Mobile was placed in the entrance to a store near a restaurant, the flies from which were most persistent and annoying in getting past the screen doors and in soiling the show windows. Since the fan has been installed not a fly is to be found in the storeroom, although the 6-ft. doorway is wide open and customers are continually passing in and out. The presence of the fan has also cut down the necessity for cleaning the show windows where the flies were formerly wont to foregather, and customers coming in off the hot street stop and cool themselves in the pleasant breeze which the fan affords.

HOUSE-WIRING RESULTS FROM A NEWSPAPER ADVERTISING CARD.

During the last sixty days the Nashville (Tenn.) Railway & Light Company has run a small advertising card in the local papers offering to wire six-room houses for six outlets at $14.75 per house, the customer paying one-fourth or one-fifth down and the remainder at $1 per month. The work was done by a local contractor who was paid $14.75 per house by the electric company upon the completion of his job, the company

being later reimbursed by the customer as above stated. Besides the newspaper advertising, no other special effort was made to get this house-wiring business, all inquiries being handled as they came in by the regular solicitors. As a result of the advertising campaign, continuing for sixty days, 100 houses were wired. The advertising cost approximated $300, according to Mr. James E. Carnes, contract agent for the company. If each of the 100 new customers pays only his minimum charge bill of $1.25 per month or $15 yearly, the company is thus assured an annual increased gross income of $1,500 a year from the $300 outlay. The same dollar-per-month payment proposition was offered on any house-wiring cost up to $25 where the owner desired to take advantage of the instalment plan of payment.

COST FIGURES OF A SUCCESSFUL HOUSE-WIRING CAMPAIGN.

During the recent forty-five-day house-wiring campaign conducted by the Mobile (Ala.) Electric Company 662 new contracts were closed. Mobile is a city of 51,000 population, about 40 per cent of which is colored, and the electric company now has 5642 consumers, all of whom, with the exception of twenty or thirty, are white. Considering only the white population served, this represents an average of one meter to every 5.5 persons. Such a figure, however, is not strictly fair for comparison with other cities, for, while the large negro population is not itself a consumer of electricity, its presence nevertheless supports some central-station business in stores, shops, etc., which would not otherwise exist.

In the course of the forty-five-day campaign, which actually comprised only thirty-nine working days, spread advertisements in the local papers described three house-wiring equipments which the company offered to have a contractor install at cost, the customer paying one-third or one-fourth down and the balance within from sixty to ninety days. These installations were estimated at the lowest possible rates and the company paid the contractor's bonus of from $1.50 to $2.50 per house, depending on the proposition A, B or C accepted. For the 563 houses actually wired the contractor thus received $965.50. Although 662 contracts were taken, ninety-nine were not actually completed, in ninety of these cases credit being withheld from the applicant, while in the nine other instances the parties moved away from their houses. As the result of the campaign it is estimated that at least 100 other prospective customers were stirred to the point of applying for service later, and the effects of the campaign were thus felt for some time after it closed, although the wiring-at-cost proposition was withdrawn promptly at the end of the forty-five-day period.

Three salesmen were employed continuously during the forty-five days, and a fourth man was used for one week. The salary cost of these men was $393.50. For each 100 contracts closed by a salesman a cash prize of $25 was offered the men, and the results of the campaign cost the company $175 in prizes. About 1675 column-inches of advertising was used in the local newspapers, including several full-page announcement displays and smaller spaces. This newspaper advertising cost $586.67. Just before these announcements were printed the company had extra copies run off to be distributed by boys from house to house. The boys were instructed to deliver a copy to all houses not reached by electric-light wires. Lantern slides relating to house wiring were also prepared and thrown on the screens at the moving-picture theaters. The dodger-sheet and slide publicity cost $17. The 662 contracts closed thus cost $2,137.67, or an average of $3.22 each.

At a conservative estimate, it is believed that the new business secured through this campaign will result in increasing the company's gross income about $10,500, as follows:

Twenty customers at $24 per year	$480
220 customers at $18 per year	3,960
422 customers at $14.50 per year	6,119
	$10,559

The above estimate is based on the assumption that only twenty of the new customers will average $2 monthly, one-third of the remainder will average $1.50 per month and the remaining two-thirds will average about $1.20 per month, the chances being, however, that these figures will be exceeded. The house-wiring campaign of the Mobile Electric Company was in charge of Mr. R. E. Flower, new-business manager. Mr. T. K. Jackson is general manager of the company.

HEATING APPLIANCES ON CONTROLLED FLAT-RATE CIRCUITS.

In the case of flat-rate systems using demand controllers heating appliances, such as electric irons, etc., are usually operated on a fixed flat rate per month, being connected in on the street side of the controller so as not to affect the latter's setting for the lamps in circuit.

A Texas central-station operator making use of a number of flat-rate controllers has tried with success the scheme of employing in residence installations a double-throw switch with the heating circuits on one side and the lamp circuits in series with the controller on the other pair of contacts. This insures, of course, that the heating circuit demand cannot be thrown on while the lighting demand is in use. As the heating load in the city mentioned is made up chiefly of irons, practically no hardship is worked on the customers. From the central-station standpoint, of course, the arrangement avoids any superimposing the heating and lighting demands.

The presence of an uncontrolled heating circuit in some cases offered temptations to attach lamps to these wires. Where such misuse was suspected a 2-to-1 auto-transformer was inserted in the lighting lines and instead of 110-volt 55-volt tungsten lamps were used. These gave the advantage of larger, sturdier filaments with increased life when properly operated. A single trial usually made clear to the customer that the 55-volt lamps could not be operated on the 110-volt heating circuit.

FREE LAMP RENEWALS IN CHICAGO.

While discussing "Maintenance of Service" in a paper read at a recent meeting of the Commonwealth Edison Branch of the National Electric Light Association Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, Chicago, gave some interesting information about free-lamp renewals by his company. The practice of exchanging good carbon-filament incandescent lamps for burned-out or defective lamps, without cost, was begun by this company in 1895. At first customers had to call at the downtown office to renew their lamps, but later outlying depots were established, and now the lamps—new lamps for old—are delivered at the customer's door on request.

With the growth of the company the cost of this free-renewal service has assumed large proportions, and it now amounts to 32 per cent of the total distributing cost, the free lamp renewals costing the company about $500,000 a year. A bureau of the operating department is in charge of this work and twelve telephone lines are needed to handle the incoming calls of customers to this lamp-renewal bureau. Seven horse-drawn wagons and five electric wagons are used in delivering lamps to customers. Both classes of vehicles for this service present an attractive appearance. Tungsten lamps, which are not renewed free, are delivered by boys traveling on street cars, each boy carrying about fifty lamps. Carbon lamps are carried in trays, and both in the delivery wagons and in the stockroom the position of the lamps in these trays indicates the character of the lamps. New lamps are placed in the trays with bases up, the old lamps being placed with tips up. By this simple method there is no trouble in distinguishing the good lamps from the bad ones.

Lamps returned by customers are carefully tested. In the

year 1910 it was found that about half the lamps returned were burned out. From 15 per cent to 30 per cent of the remainder were broken, and from 15 per cent to 30 per cent were found to be good after testing and were returned to service, many of them being used by the company itself in substations and elsewhere. It has been found that by handling the returned lamps carefully the percentage of serviceable lamps has been increased to a noticeable extent.

BOOMING ELECTRIC COOKING IN MONTANA.

The Billings & Eastern Montana Power Company, Billings, Mont., has just closed a very successful demonstration of electric cooking, which was commenced on May 10 in a large hall. On May 15 a dinner was served to the Chamber of Commerce and the city officials, the Mayor of the city presiding, at which 100 guests were entertained. The dinner was entirely prepared by electricity and was such a decided success that electric cooking received the hearty indorsement of every business man present, which naturally favorably impressed the public at large. Following is a list of foods cooked and baked for the dinner: Baked, twenty-two loaves of bread and twenty cakes; roasted, 26 lb. of beef; stewed, 20 lb. of potatoes and twelve cans of June peas; 8 gal. of coffee were made. The bread and cakes were kneaded and the coffee ground by electric power, all at a cost of less than $1 for the entire meal for 100 guests.

During the demonstration, which lasted a week, the sales included twenty-five stoves, three vacuum cleaners, four electric washing machines, one 14-qt. coffee urn, one dozen electric irons, coffee percolators, etc., the total value being $2,500. Over sixty electric stoves are now installed in the city, which has a population of but 10,000. There has been no complaint about any stove, and, in general, the people are enthusiastic on the subject of electric cooking. It is expected that the demonstration will be the means of selling over 100 electric stoves, which will mean an increase in revenue of at least $400 per month. In fact, with the approach of warm weather there may be difficulty in supplying the demand. We are indebted to Mr. J. F. Roche, manager of the Billings & Eastern Montana Power Company, for the above information.

MOISTURE CONDITIONS PREVENT GROUNDING OF SECONDARIES AT GALVESTON, TEX.

The salt, wet air encountered at Galveston, Tex., so thoroughly permeates all buildings with conducting moisture that it is impossible to ground the secondaries of transformers on account of the painful shocks given from brass socket shells or other metal parts which make contact with the ungrounded side of the line. Buildings of wood, brick or concrete become so conducting after brief exposure to the climate of this semi-tropical island that even when standing on carpeted floors on upper stories one finds it impossible to touch any live conductor at ordinary lighting voltages. The capacity leakage effect from even ungrounded secondaries in many cases proves unpleasant. Being an advocate of grounded secondaries elsewhere, when Mr. Fred M. Lege, Jr., the present manager of the Brush Electric Lighting & Power Company, first came to Galveston several years ago he immediately took precautions to see that his own house service was properly grounded. Painful shocks at once became manifest from various sockets and switches, and members of the family and servants soon grew so fearful of all outlets that the ground had to be removed. The model lighting installation at Ft. Crockett, the government post at Galveston, is equipped with grounded secondaries which have given rise to much lightning and fuse trouble, making it also impossible to replace fuses without removing voltage from the lines. The climatic conditions at Galveston also make it necessary to use porcelain instead of wooden strain insulators, besides other modifications of standard construction practice.

MOVING-PICTURE DRAMA TO DEMONSTRATE CENTRAL-STATION SERVICE.

The adventures of a young married couple with a smoky cook-stove and an impudent servant who leaves without warning, the wife's unproductive efforts in the old-fashioned kitchen, the husband to the rescue with a complete set of electric cooking and household appliances, and the comfort and satisfaction which thereafter ensue are shown in the form of a connected and interesting moving-picture drama now being exhibited nightly to crowds in the Commonwealth Edison exhibit hall at the White City amusement park, Chicago. The charm and interest of the present display, unlike previous mere-demonstrating pictures that have been shown, lies in the continued thread of plot which permits the electrical devices to be brought in without effort, and though these electrical details are given a prominent part, the story contains sufficient of human interest to hold the attention of every spectator until the 1500 ft. of film have been run off.

The little drama opens with a kitchen interior, showing a fat and untidy hired girl, who furnishes the comedy for the piece, in her efforts to build a fire in the smoking coal stove. While she divides her time between emptying the ashes and getting food ready for cooking it grows late, breakfast is delayed, and at last the head of the house takes part in a stormy interview in the kitchen. The hired girl determines to leave, collects her wages, and departs, while the young wife attempts to complete the breakfast arrangements. Unequal to the task with the old-fashioned utensils provided, her husband insists that she give up the attempt, and he goes to his club for breakfast. There, while discussing the evils of the servant problem with his friends, one of them shows him a newspaper advertisement of the Commonwealth Edison Company, "the servant problem solved by electricity—cooking, washing, ironing, cleaning."

The next picture shows the man of the performance swinging down Michigan Boulevard coming from his club. After a few glances about he notes the location of the Electric Shop, enters, and explains his needs to a gentlemanly attendant, who escorts him through the exhibit rooms demonstrating toasters, flatirons, chafing dishes, electric ranges, sewing machines, etc. After a number of interior views on the main floor the pair enter the push-controlled electric elevator and descend to the demonstration rooms below. This is said by moving-picture men to be the first time an elevator has been successfully shown in a film.

Other demonstrations of vacuum cleaners, washing machines, etc., follow; meanwhile the attendant has been noting down orders as each successive appliance strikes the fancy of the customer. A busy street scene in Michigan Boulevard shows the appliances being loaded into one of the Commonwealth company's electric trucks for delivery to the house. There they are quickly set into place, making a completely equipped electric kitchen and laundry. The wife is, of course, delighted, and with a pretty show of enthusiasm tries each device in turn, not forgetting to express her appreciation to the head of the house. Another servant girl is secured, this time a neat, trim maid, who goes busily about her electric cooking, washing, ironing and housecleaning wearing the starchiest and whitest of aprons. A model electric meal is served, and at its close the dishes are swept from the table in a twinkling—the one bit of legerdemain in the film—which closes with a series of character studies in facial expressions of the man of the house, his cigar and his electric cigar-lighter. No expense was spared by the Commonwealth Edison Company in staging the film. Experienced motion-picture actors were employed to take the parts, and while special scenery was prepared for some of the views, the Electric Shop and Chicago street scene provide the loci for most of the action. The film is of unusual length, 1500 ft., and the details and idea of the playlet, which is entitled "Solving the Servant Problem," are due to Mr. Charles F. Stark, of the advertising department of the Commonwealth Edison Company.

PURCHASING COAL ON A HEAT-UNIT BASIS.

The Birmingham (Ala.) Railway, Light & Power Company purchases its coal under a contract with the mine by which payment is made entirely on the basis of the quality of the fuel furnished, as shown by chemical test. These tests, which are made on a 100-lb. sample taken from each shipment, include a determination of the heat-unit fuel value of the coal and the quantities of sulphur, moisture and ash material present.

According to the six-year contract which the company has entered into with the coal dealer it agrees to pay $1.55 per ton for the coal, on a basis of 13,000 lb.-Fahrenheit units per pound. For all deviations shown by the test results from this 13,000 heat-unit standard the coal company is paid proportionately, receiving a premium when the fuel content runs above the base value and sustaining a proportionate reduction when it falls below 13,000 heat units.

Further premiums and deductions are granted the dealer with regard to the ash content of the fuel as follows:

7 to 8 per cent ash, 9 cents per ton premium.
8 to 9 per cent ash, 6 cents per ton premium.
9 to 10 per cent ash, 3 cents per ton premium.
10 to 12 per cent ash, no correction.
12 to 13 per cent ash, 3 cents per ton deduction.
13 to 14 per cent ash, 6 cents per ton deduction.
14 to 15 per cent ash, 9 cents per ton deduction.
15 to 16 per cent ash, 12 cents per ton deduction.
16 to 17 per cent ash, 15 cents per ton deduction.
17 to 18 per cent ash, 18 cents per ton deduction.
18 to 20 per cent ash, coal rejected.

Part of the sample is also subjected to a drying temperature and its loss in weight noted as the moisture is driven out. Three per cent moisture content by weight is allowed, but for all water present above this amount proportionate correction is made in the car-load weights of the coal.

As long as the sulphur content of the coal remains below 1 per cent no deduction is made for the presence of this material, but for sulphur in excess of this amount penalties as follows are subtracted from the purchase price of the coal per ton:

1 to 1¼ per cent sulphur, 5 cents
1¼ to 1½ per cent sulphur, 10 cents
1½ to 1¾ per cent sulphur, 15 cents
1¾ to 2 per cent sulphur, 20 cents
Above 2 per cent. sulphur, coal rejected.

The contract stipulates the delivery of the coal in drop-bottom cars, and provides for a deduction of 5 cents per ton from the price of all coal not delivered in such cars. In case the specifications for the thermal units, ash, sulphur or moisture in the coal are continually infracted to a degree that may be deemed injurious to the plant equipment, the company reserves the right to cancel the entire contract. The price of the coal contracted for is based upon a certain wage payment to the miners, and if during the life of the contract this wage scale is raised the electric company agrees to pay the coal company proportionately. The Birmingham company is now burning from 300 tons to 500 tons of coal a day at its main generating station, from which the local lighting, power and street-railway services are supplied.

Mr. F. V. Underwood, electrical superintendent for the company, declares that after two years' experience with the thermal-unit basis of purchasing fuel he has found the results of the arrangement mutually and highly satisfactory to both the mine and the plant interests. The scheme insures that the electric company gets the best output of the mine. The mine is paid at a higher rate for this superior product and the electric company profits by its better combustive properties. The analytical-test results of the 100-lb. samples from each shipment, which include both lumps and fine coal, are prepared in triplicate, one copy being retained by the chemist, one going to the superintendent's office, and the third being sent to the coal company, providing it with the data from which its bill is prepared. When desired a chemist representing the coal company checks the work done by the electric company's analyst. In case of dispute it is provided that the issue be submitted to an impartial laboratory for retest of a sample from the same shipment.

PURCHASING COAL ON A MINE-RUN BASIS.

At the third annual convention of the International Railway Fuel Association held at Chattanooga, Tenn., May 15 to 18, a number of papers were presented on locomotive fuel subjects. Two of general power-plant interest were those by Dr. J. A. Holmes, director of the United States Bureau of Mines, "Fuel Investigations," and by Prof. A. A. Steel, of the University of Arkansas, entitled "Some Results of Buying Coal Upon a Mine-Run Basis."

Professor Steel recounted how formerly in the purchase of coal only the lump material was valued and paid for until changing conditions and the reduction in the price of blasting powder resulted in less careful mining, producing a larger proportion of slack. As soon as this slack coal became a marketable commodity the cost of mining and the sale of the coal came to be figured on a run-of-mine basis and the miners were paid on this scale, although, of course, a ton of coal largely made up of slack was more easily mined and handled than a ton of the superior lump material. In some states coal purchasers are thus required to pay full price for all sizes of coal and slack as well as for whatever slate is mixed in the material. Lately the miners have learned to reduce the number of shots by increasing the power per shot, so that even the tight masses of coal are converted into little better than slack. The heavy shots also often cause masses of slate to fall from the roof, lowering the quality of the coal. The miners gain by these larger shots since they have fewer holes to drill, require but little more powder per hole and remove much larger quantities of coal.

Professor Steel spoke of the difficulties in introducing mining machines owing to the miners' prejudice, since it is easier to shovel up slack than to break up and load machine-cut lumps. As long as the mine-run basis persists, declared the speaker, this condition will continue. The only way to be sure of good-quality coal is to buy it upon a lump basis, or at least to pay more for lump coal than for slack. Jaw crushers equipped with long pick points on one jaw and with a bar screen on the other break up the lumps with the production of the least fine slack, but such equipment is expensive for the small mines to install.

GAS ENGINE PLANT ADDITIONS AT SAPULPA OKLA.

A 400-kw twin-tandem, horizontal Allis-Chalmers gas-engine-driven alternator set is being added to the new power-house equipment of the Sapulpa (Okla.) Electric Company, the first 250-kw single tandem-cylinder gas-engine set of which has been in operation since last May. With the rapid growth of Sapulpa this initial unit was soon loaded to a point where it was considered unwise to solicit more business until additional capacity could be secured. The new engine will shortly be ready to run, and an active new-business campaign has been formulated, including house-wiring and business-section lighting. Sapulpa is in the midst of the world's greatest oil field, and as natural gas sells locally at from 25 cents for lighting down to 4 cents for power purposes, the electric-motor business challenges sharp competition.

To advertise Sapulpa the local central-station company has offered to the municipality to install free of charge a 32-ft. x 20-ft. tungsten sign, on posts 40 ft. apart, spanning a principal street, the sign reading: "Sapulpa, the Oil City of the Southwest." Around the word "oil" colored lamps and a flasher will simulate the effect of flames. The sign will contain 675 low-voltage tungsten lamps. The company has offered to erect this sign free of charge to the city provided that it shall have a ten-year contract for lighting the sign from dusk to midnight for $75 a month.

The Sapulpa Electric Company is operated by H. M. Byllesby & Company, Chicago, Mr. Harry B. Wales being local manager at Sapulpa.

ESTIMATING THE COST OF ENERGY.

In leading a discussion before the Toledo Section of the American Institute of Electric Engineers on April 7 Mr. Marvin W. Hansen stated that if the local company is losing money on energy furnished certain classes of consumers, the system of computing cost of production is all wrong. Mr. Hansen argued that the question is not so much one of production as it is of non-consumption. Under the present system, he said, the large consumer pays the fixed charges against the small consumer.

The three fundamental principles in fixing charges for service, Mr. Hansen stated, are as follows: First, a fixed load for each consumer; second, a fixed charge per year for this load; third, a fixed low rate for the amount of energy used. For the residence consumer he thought that the fixed load should be determined as one-half the possible demand. To arrive at the possible demand circuit interrupters should be used and the consumer would be able to ascertain at any time whether he was using energy at too rapid a rate or not.

Mr. Hansen estimated the cost of energy for residences of average size as follows: Cooking, $1.80 per month; ironing, 10 cents; washing, 20 cents; electric fans, ten hours per day, 15 cents; heating room 16 ft. x 20 ft., $3; house cleaning with vacuum cleaner, 10 cents.

On this basis, he said, as nearly as he could determine, the highest cost per kilowatt installed is $60, which, plus an equal amount for distribution, would make $120 the fixed cost to the company for each consumer having a load of 1 kw.

COST OF MAGNETITE-ARC LIGHTING IN WORCESTER.

Exhaustive figures bearing upon the cost of magnetite-arc lighting were presented by the Worcester (Mass.) Electric Light Company at a recent hearing before the Massachusetts Gas and Electric Light Commission on the petition of Mayor James Logan for a reduction in the prices charged the city for the illumination of its thoroughfares. At former hearings the petitioner introduced testimony to show that a fair price for the service would be about $65 per lamp per year. The company's figures showed that under present conditions the cost is $96.28 per lamp, including a 6 per cent interest charge. The 4-amp magnetite lamp of General Electric manufacture is used in Worcester and an all-night and every-night service is rendered at a price of $91.25 per lamp per year.

TABLE I.—INVESTMENT IN MUNICIPAL ARC SERVICE (900 4-AMP MAGNETITE LAMPS). PRESENT VALUE.

Apparatus.	City's Figures.	Company's Figures.
Lamps, machinery, poles and appurtenances	$48,500(b)	$42,716 (d)
Steam plant	15,000	10,465
Buildings and real estate	5,000	7,349
1,279,971 ft. No. 6 B & S copper wire (a)	11,500	31,386 (e)
	50,000 poles	129,871 (f)
	wires (c)	
100 miles single duct (g)	160,000	214,804
Totals	$290,000	$436,591

The following tables show in detail the company's methods of determining the cost of the service. The analysis is one of the most complete thus far made in the practice of moderate-sized central stations and is particularly suggestive for the reason that practically the entire service of the city was rendered by a single type of arc lamp. The Worcester company was one of the earliest in the country to adopt the magnetite system. No other plant in Massachusetts outside the Boston Edison company has so much underground conduit installed.

In Table I item (a) is the amount in use June 30, 1909. Item (b) includes a part of the generator plant. Item (c) is based upon a valuation by the city's expert of about 4 cents per foot, or a depreciation of more than 75 per cent from the initial value of the wire. The company contends that the city's value is absurd since the initial cost of the wire is 18.5 cents per foot. The company's estimate of the value of the wire at present is about 12 cents per foot, although the wire is as efficient as when first installed six years ago. If the company maintained a higher value, which might be legitimately done, the depreciation would be larger and the cost greater per lamp. Item (d) is made up of generator plant, $3,429; station equipment, $20,093, and arc lamps, $19,194, the total being $42,716. Item (e) includes the following at the book values given against each:

Lamp poles	$10,438.00
Fixtures	15,443.50
Arresters	967.50
Line poles (municipal arc portion)	15,000.00
Total	$41,849.00
Estimated depreciation 25 per cent	10,463.00
Present value	$31,386.00

Except some line poles this is all about five years old. Depreciation is taken at 10 per cent for an average of two and one-half years.

Item (f) is made up as follows, the figures being as of June 30, 1910:

1,022,012 ft. No. 6 B & S underground lead-covered copper wire at 12 cents	$122,461
32,968 lb. No. 6 weatherproof copper wire at 12 cents	3,943
38,864 ft. No. 6 rubber-covered wire at 10 cents	3,287
Present value, total	$129,871

These valuations were given as a matter of expert opinion, but were verified by the following statement of costs and estimate of depreciation:

1,022,012 ft. No. 6 wire as above, initial cost 18½ cents	$189,072
32,968 lb. No. 6 wire as above at 15 cents	4,945
32,864 ft. rubber-covered wire as above, at 15 cents	4,929
Total initial cost	$198,946

Average age six years. Average depreciation on underground wire taken at 6 per cent per year and on other wire at 10 per cent per year.

36 per cent of $189,072	$68,065
60 per cent of $4,945	2,967
60 per cent of $4,929	2,957
Total depreciation	$73,989

Deducting this depreciation from the initial cost leaves a present value of $124,957, or within $5,000 of the preceding estimate.

The lengths and values of the different classes of ducts are as shown in the first table on the following page.

The original cost of ducts to June 30, 1910, was $666,538, and the total length of ducts to June 30, 1910, was 1,731,141 ft. The average cost of construction at Worcester per foot of duct is $0.385 and the average age of ducts seven years.

Depreciation on ducts, including obsolescence, has been charged at 3.5 per cent per year, giving a total depreciation of 24.5 per cent in seven years. The original cost of ducts was 38.5 cents per foot and the depreciation 9.5 cents, hence the present value of ducts is 29 cents per foot.

I. Revenue Ducts.		
Municipal arc ducts, at 29 cents	430,000 ft.	$124,700
Commercial arc ducts	47,000 ft.	13,630
Incandescent ducts	430,000 ft.	124,700
Power ducts	100,000 ft.	29,000
Totals	1,007,000 ft.	$292,030
II. Non-Revenue Ducts.		
Vacant ducts	372,141 ft.	107,920
Totals	1,379,141 ft.	$399,950
Free City Ducts	352,000 ft.	102,080
Totals	1,731,141 ft.	$502,030

The company points out that this depreciation is very high. If taken at only 2 per cent the present value would be 38.5 cents less 14 per cent, or 33 cents instead of 29 cents. The latter figure was, however, allowed to stand by the company, particular emphasis being laid upon the fact that the allowance of such high depreciation charges means a serious scaling down of the present value of the investment in arc-lighting equipment and consequently favors the city.

The proportion of municipal arc ducts to all ducts except the free city duct is 31.2 per cent. The proportion of vacant ducts to all except the free city ducts is 27 per cent. Interest and depreciation on the free city ducts, such ducts being now and perpetually non-revenue-producing and practically a special tax or exaction for the privilege of laying the other ducts, must be carried by the other ducts in the proportion that each class of ducts bears to all the ducts except the free city ducts.

Value of municipal arc ducts as above	$124,700
31.2 per cent of value of free city ducts ($102,080)	31,849
	$156,549
Value of vacant ducts as above	$107,920
27 per cent of value of free city ducts ($102,080)	27,561
	$135,481

But these non-revenue-producing ducts must also be carried by the revenue-producing ducts until they become self-sustaining, so that to the augmented value of the municipal arc ducts above ($156,549) a sum ($58,256) must be added on the following basis:

Ratio of municipal arc ducts to all revenue ducts, 43 per cent	$156,549
43 per cent of corrected value of all vacant ducts ($135,481) is	58,256
Total corrected investment in municipal arc ducts	$214,805

RECAPITULATION.

Total investment	$436,591
Depreciation, 5 per cent	21,829
Interest or profit, 6 per cent	26,195
Charges	$48,024
For 900 lamps, or $53.58 each.	

Taking 5 per cent average depreciation and 6 per cent as a reasonable profit, the investment cost per lamp is as given above.

The total operating expenses for 900 lamps are $28,680.42, or $31.87 per lamp.

The city's expert, Mr. W. D. Marks, of New York, allowed $29.81 for operating expenses, but included no allowances for patrolmen or general expenses. These amount to $4.27 and $1.74 per lamp per year respectively, and when included bring the operating cost as estimated by the petitioner to $35.82 per lamp per year.

The total energy output for street-lighting service in Worcester in the year ended June 30, 1910, was 1,326,104 kw-hours and the connected load of the street-lighting service is about 360 kw.

TABLE II.—DEPRECIATION, ITEMIZED.

Lamps, Machinery, Poles and Appurtenances.	
Electrical plant, $23,523 @ 10%, $2,352	
Arc lamps, $19,194 @ 10%, $1,919	
Poles and fixtures, $31,387 @ 10%, $3,139	$7,410
Steam Equipment.	
Steam plant, $10,465 @ 7%	723
Land and Buildings.	
Land, $1,831, no depreciation	
Buildings, $5,518 @ 2½%	138
Wires.	
Underground, $122,641 @ 7%, $8,585	
Overhead, $7,230 @ 10%, $723	9,308
Ducts.	
$214,804 at 2%	4,296
Total	$21,874

(An average depreciation of 5 per cent on the municipal arc investment is $21,829.)

TABLE III.—TAXES AND INSURANCE.

Total investment of company June 30, 1910	$1,459,483
Present value of equipment in municipal arc department	436,591
Ratio of latter to former	29%
Taxes (total).	
(a) On real estate	$2,885
Machinery, etc	19,188
State tax	8,947
Commission tax	373
	$31,393
29 per cent attributable to municipal arc department	9,104
(b) U. S. income tax, total	$1,041
Income from municipal arcs is 20 per cent of total, or	78,791
20 per cent of income tax is	208
Cost of Insurance, Total of Company	$7,127
Municipal arc equipment is 8.6 per cent of total equipment, so 8.6 per cent of the total insurance is	641
Total insurance and taxes municipal arcs	9,953
Taxes and insurance per lamp	11.06

TABLE IV.—OPERATING EXPENSES OF MAGNETITE SYSTEM.

Item.	Total Expense.	Fixed Charge.	Output Charge.
Engineers' wages	$460.64 } 8.6 %	$460.64	.....
Firemen's wages	468.52 } of	468.52	.....
Dynamo tenders' wages	887.88 } total	887.88	.....
	} proportioned on		
Fuel	9,281.64 } station output.	.....	$9,281.64
Oil, water, waste	480.00 }	.....	480.00
Station expense	3.32 } 8.6 %	3.32	.....
Repairs, building	46.30 } of	46.30	.....
Repairs, steam plant	860.82 } total	430.41	430.41
Repairs, electrical plant	177.98 } on output	.....	177.98
Rectifier tubes	1,920.00 actual cost	.....	1,920.00
Patrolmen	3,847.60 " "	.....	3,847.60
Trimmers	909.40 " "	.....	909.40
Repairs, poles, lines	1,828.12 " "	914.06	914.06
Repairs, underground	957.76 " "	478.88	478.88
Repairs, arc lamps	2,105.94 " "	.....	2,105.94
Globes	387.00 " "	.....	387.00
Carbons	1,068.00 " "	.....	1,068.00
Sundries	1,423.08 " "	711.54	711.54
General expense	1,566.42 8.6% of total	1,566.42	.....
Total	$28,680.42	$5,967.97	$22,712.45

In the preliminary cross-examination of Mr. Smith the above data were unshaken by the petitioner's counsel. The additional points were brought out that the magnetite installation necessitated the purchase of a new rectifier board at a cost of $23,500, which the company can use for nothing else but arc or series

TABLE V.—GRAND TOTALS OF ACTUAL ANNUAL COSTS.

Items.	For 900 Lamps.	Per Lamp.
Interest on investment at 6 per cent (Table I)	$26,195	$29.10
Depreciation @ 5 per cent (Table II)	21,829	24.25
Taxes and insurance (Table III)	9,953	11.06
Operating expenses (Table IV)	28,680	31.87
Total yearly cost	$86,657	$96.28

incandescent street lighting. Station reconstruction included a concrete floor, $1,224; special wiring, $1,046; labor, $1,420; crane, $1,800, and arc-distributing board, $4,499. Twenty-three tub transformers are in service in the Worcester installation, and the average initial cost of the arc lamps is $25 each. The hearing was continued.

Wiring and Illumination

CREOSOTED POLES IN BIRMINGHAM, ALA.

Poles of Southern pine impregnated with creosote to the amount of 12 lb. per cubic foot of wood have been adopted by the Birmingham Railway, Light & Power Company as its standard line construction. Mr. F. V. Underwood, electrical superintendent for the company, expects poles thus treated to show lives of at least twenty-five years, basing his conclusions on observations of creosoted poles that have been in use in Birmingham over a long period.

Following the vacuum treatment of the entire pole, the creosote preservative is driven into the pores of the wood under a pressure of 125 lb. per square inch, insuring that each cubic foot of wood receives about 12 lb. of creosote. After the pole has been in the ground for some time it is found that the creosote material works down from the top of the pole toward the butt, increasing the density of impregnation at the ground line, where the pole is most subject to deterioration. Some of the creosote also penetrates out into the surrounding earth as a gummy tar, forming a water shed about the pole base.

Poles thus treated, delivered to the electric company, cost about twice as much as ordinary untreated wood, but the life of such creosoted poles is declared to be indefinite, outlasting several wood poles at least. Examination of creosoted poles taken up after five years in the ground disclosed no deterioration whatever in the structure of the wood. Besides the saving in pole cost resulting from the longer life of the doubly expensive creosoted pole, there are important additional economies in the labor costs of setting new poles, replacing cross-arms, maintenance, etc., and all of these must be considered. The creosoted poles cost the Birmingham Electric Company as follows:

30-ft. poles, 8-in. tops, $6.95.
35-ft. poles, 8-in. tops, 7.85.
30-ft. poles, 10-in. tops, 8.30.
30-ft. poles, 13-in. tops, 11.35.
35-ft. poles, 10-in. tops, 9.90.

A disadvantage offered by the creosoted poles is the damage they sometimes do, when new, by soiling the clothes of persons who brush against them. In the hot sun some of the creosote is distilled out to the surface of the pole where it adheres as a sticky black tar. The Birmingham company has had to settle several damage accounts of this kind, but after the pole has been exposed to the elements for a short time it becomes as innocuous as any painted surface.

FIREPROOF WIRING IN TELEPHONE BUILDINGS.

As a result of an investigation into conditions of internal fire hazards and external exposures of its telephone exchanges, the Colorado Telephone Company is making arrangements to systematically eliminate these hazards to the greatest possible extent. The plans will entail the adoption of conduit wiring for all lamps and motor circuits, fireproof inclosures for all fuses on these circuits excepting in fireproof buildings, metallic inclosures for all motors except in fireproof buildings and special arrangements for drop cords, movable lamps and the like. Exposures will be removed by the use of metal frames and wired-glass windows and by roller fire shutters for exposed door openings. Heating devices will be all standardized and the present interior protection devices supplemented.

The American District Telegraph Company, of Denver, Col., of which Mr. E. B. Field, Jr., is president, is now engaged in moving its entire central-station equipment from a basement room in the eight-story fireproof building of the Colorado Telephone Company to a small one-story unexposed building about a block distant, to be occupied solely by the A. D. T. central station.

ADEQUATE ILLUMINATION FROM THE CIVIC STANDPOINT.

The St. Louis *Times* editorially presents its readers with something to think about on the subject of ample street and shop-window lighting in its issue of May 18. "To-day," remarks its editorial paragrapher, "the progressive merchant has as many lamps as he can use effectively, and he permits them to burn as long as there are people abroad on the streets. The storekeeper who has a pretty window realizes that a flood of light in that window is more eloquent than the best salesman. Moreover, he knows that by contributing his share of the bright light to the streets he is helping to advertise his city.

"An expert recently declared that Broadway, St. Louis, is the best-lighted street in the world. Can any one estimate the value of that advertisement to St. Louis? Would it not bring a certain return in dollars and cents if every street in St. Louis was as well illuminated as Broadway? Would not the footpad give way to the delighted visitor who might carry the praises of the city abroad?"

ELECTRIC-LIGHTED CROSS ON CHURCH STEEPLE.

Attention has been attracted by a cross outlined in electric lamps on the steeple of St. Mel's Catholic Church, at Forty-third Avenue and Washington Boulevard, Chicago. The cross is 9 ft. high and 6 ft. wide. Each side of it is outlined by thirty 4-cp carbon lamps, the total installation consuming 1.16 kw. The specific consumption of the lamps used is 4.7 watts per candle. This cross can be seen very distinctly at night for a distance of twenty-five city blocks in a direction at right angles to the arms of the cross. Rev. Father McDonald, who is in charge of the church, expresses himself as well pleased with the results obtained by the use of electricity for lighting this church emblem.

The change will also include the entire standardization of all central-station equipment, the use of conduit for all wiring, of slate, glass and iron for all register tables, switchboards and protection panels, and the necessary open connections will be all flame-proofed. Independent storage battery and two motor-generator sets will be provided in the basement cut off from the remaining apparatus by concrete floor slab with no communication. One motor-generator will receive energy from the 220-volt alternating-current secondaries of the Denver Gas & Electric Company and the other from the 500-volt trolley supply of the Denver City Tramway or from the 440-volt direct-current motor circuits of the Denver Gas & Electric Company. The battery will be in duplicate, each portion capable of serving the central station for thirty hours continuously. In this watch service system some 85 per cent of all the lines are in underground cables of the Colorado Telephone Company, using No. 19 wire in cables, and the pairs being made available for the watch service upon requisition from the telephone company.

In connection with this isolation of the watch service from the telephone central station, the rewiring in conduit of all customers' installations is rapidly proceeding, and there have been developed new registers and signal boxes showing very pronounced advantages over older types.

STREET LIGHTING IN PUEBLA, MEXICO.

By Roscoe Scott.

Perhaps the title "Great White Way" could be applied with greater aptness to a well-lighted Mexican street than to most of the Broadways and Main Streets which have laid claim to that distinction in the United States. The most common color for exteriors of buildings in the tropical republic is, roughly speaking, white, and this, of course, tends toward efficiency in street lighting since reflection aids materially in brightening the roadway. The reflecting value of a white building is well illustrated in Fig. 1, a view of the Kioska substation of the Puebla Tramway, Light & Power Company. The structure is outlined with 5-watt, 12-volt sign lamps.

Puebla boasts the first installation of tungsten-filament series lamps on poles in the Republic of Mexico—an installation which for decorative beauty compares most favorably with many of its Northern prototypes. Before describing this system, however, it may be of interest to present a few salient facts about the city itself.

Puebla, as American cities go, is very old. All the records of the municipality, dating back to the year of its foundation, 1521—a century before the Pilgrims landed—are preserved in its archives. The 1910 census indicated a population of about 102,000. Puebla the state—of which Puebla the city is the capital—is the richest agricultural state in the Mexican Republic. The city, which is about 85 miles east of Mexico City, is a great cotton-factory center and on this account is often spoken of as the "Manchester of Mexico."

Puebla is also famous for its old-established ornamental iron-work industry. The finest ornamental tiles made in the Republic of Mexico are the product of Puebla factories, where very good reproductions of the old Talavera ware may also be purchased. As the city is close to the famous onyx quarries, naturally, a specialty is made of the cutting and polishing of this beautiful decorative material, which in such a mild climate can be used even for exterior work. Recently a complete modern drainage system and an excellent water-supply system have been installed, the latter including a reinforced-concrete reservoir and two electric pumping stations of the most modern type, using centrifugal pumps. A duplicate of both pump and motor installation exists in each pump house. All the city streets have been repaved within the past three years, the central thoroughfares being provided with asphalt pavement and the outlying streets, macadam finished with crude oil.

Electricity for the power and lighting lines of the Puebla Tramway, Light & Power Company is generated by three water plants within 15 miles of the city, with an aggregate capacity of about 10,000 hp. The high-tension distributing system comprises about 120 miles of line for supplying power, in addition to that delivered in the city of Puebla, to the following towns

Fig. 1—Substation of Light and Power Company, Puebla.

or districts: Atlixco, Cholula, Panzacola, Santo Domingo, Santa Ana, San Pablo, Santa Cruz, San Manuel, San Geronimo, San Felipe, Apizaco and San Rafael. Arrangements are being made to develop a fourth fall situated about 60 miles from the city of Puebla, which will bring an additional generating capacity of about 35,000 hp, making an aggregate of 45,000 hp.

The new street-lighting system employs lamps of the metal-filament 100-watt "street-series" type, with clear bulbs. These were supplied by the Buckeye Electric Lamp Company, of the City of Mexico. They are installed five in series on constant-potential circuits. The standard lamp-post which has been adopted consists of an artistically designed cast-iron upright

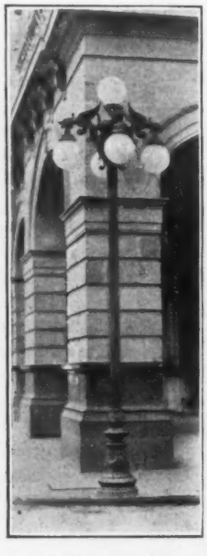


Fig. 2—Ordinary Street Standard.

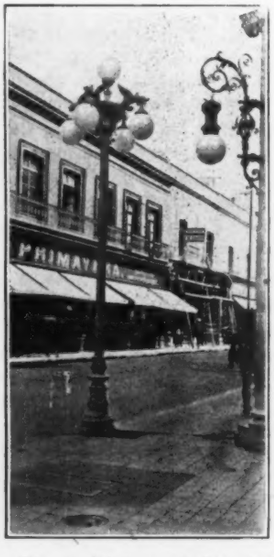


Fig. 3—Fixture at Street Corner.

having four arms at the top. Each arm is equipped with a spherical globe, 13 1/16 in. in diameter, of special diffusing glass, containing a single 100-watt lamp, while a fifth lamp and globe surmount the entire fixture. The standards were designed

and executed in the city of Puebla by Landa Hnos. The conception of a winged dragon or gargoyle is used for the arms at the top of each post. The lowest part of the pole is of elaborate design in all cases, while the central portion

Fig. 4—Elaborate Standards on the Zocalo.

is plain for most of the standards, but is very elaborately designed in the case of some of the units which occupy prominent positions on the Zocalo, or public park of the city.

The best lighted part of Puebla is the Zocalo. The broad poles which encircle this are illuminated, as seen in Fig. 4, by central rows of units spaced about 15 m apart. The main business section of the city surrounds the Zocalo and the streets are to be illuminated by units staggered normally about 30 m apart on a side. When the entire city has been lighted in this way, as is the present intention, there will be approximately 1000 lamps in service. The average illumination at the street level is estimated by the engineers in charge to be nearly 0.5 ft.-candle.

The efforts of the management of the Puebla Tramway, Light & Power Company to introduce series tungsten lighting have been appreciated and seconded by the progressive mayors of the city and the no less progressive governors of the state. Preliminary negotiations for the installation were conducted while Señor Francisco de Velasco was Mayor, and during the period in which he served all details were fully discussed by the Council and approved. The contract was signed by the present Mayor, Señor Antonio Perez Marin, who enthusiasti-

Fig. 5—Street Lighting, Showing Staggering of Units.

cally supported the project. Señor J. Rafael Isunza, Governor of the state, without whose approval no such contract may be made by any municipality, being thoroughly aware of the undoubted benefits which would accrue to the city from this system of lighting, saw his way clear to approve the contract, and the greater part of the installation was finished by May 5.

Good street lighting, as has been found out in the United States, is contagious, and cities show a disposition to emulate each other. It will be interesting to see how long Puebla, which has for years been one of the best lighted and is now said to be the very best lighted city in Mexico, succeeds in maintaining its reputation.

LIFE OF SERIES TUNGSTEN LAMPS AT CEDAR FALLS, IOWA.

Mr. J. P. Jones, superintendent of the Citizens' Gas & Electric Company's substation at Cedar Falls, Ia., gave some valuable figures before the Iowa Electrical Association convention at Davenport, April 20, on the life of series tungsten lamps in use for street lighting at Cedar Falls. The record is for two years seven and a half months, from July 15, 1908, to April 1, 1911. There are 248 lamps still in service which have not burned out. The average hours these have burned is 2708. Six and five-tenths per cent have burned an average of 330.8 hours; 5.3 per cent have burned an average of 706.5 hours; 25.8 per cent have burned an average of 1444 hours; 17.7 per cent have burned an average of 2498 hours; 16.5 per cent have averaged 3432 hours; 19.3 per cent have averaged 4409 hours, while 8.9 per cent have averaged 5484 hours. Of the lamps which have burned out in service there are 407 with an average life of 1213 hours. This low average, compared with the lamps still in service, is accounted for by the improvement in life of lamps purchased and installed the latter part of the period. Of the lamps burned out 32.9 per cent averaged 192 hours; 20.1 per cent averaged 734.4 hours; 25.1 per cent averaged 1399 hours; 12 per cent averaged 2398 hours; 6.2 per cent averaged 3372 hours; 3.7 per cent averaged 4254 hours. Of the total number of lamps which have been used, including those still in use and those burned out, there were 655, the average life of which was 1838 hours. The present number in service is 253. The sizes of lamps in use are the 40-watt, 6.6-ampere and the 40-watt, 3-ampere. Cost of lamp-maintenance material only was $248.27 for 1910, with an average of about 230 tungsten lamps in service.

LETTER TO THE EDITOR.

Library of the Engineering Societies, New York.

To the Editor of Electrical World:

SIR:—I desire to call your especial attention to the facilities offered by the library of the Engineering Societies, at 29 West Thirty-ninth Street, New York City. The library is formed from the combined libraries of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers, and contains over 40,000 volumes on engineering subjects. It is open for reference to the general public, without charge, every day and evening, except Sundays. The library is supplied with all the published indexes, has most complete sets of periodicals, both domestic and foreign, and a well-trained reference staff.

Students residing in New York City and vicinity are especially invited to utilize the library in their researches on technological subjects. The library is on the top floor of the United Engineering Society Building, is quiet, well-lighted and ventilated. Those who are prevented from visiting the library by distance or business engagements may nevertheless receive assistance. The library is prepared to furnish references on engineering subjects to persons at a distance, and also to furnish transcripts, translations and photographic reproductions of diagrams and maps. For such work, if extensive, a moderate charge is made. Correspondence is welcomed, telegraphic and telephonic inquiries will receive especial attention.

New York. W. P. CUTTER, *Librarian.*

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Maximum Current in Secondary of Transformer.—J. S. Stone.—A paper on the conditions of the maximum current in the secondary of an alternating-current transformer. The author considers particularly the condition in which the amplitude of the secondary current has its greatest value. In practice this condition is in general attained by the adjustment of the capacities, inductances and mutual inductance of the primary and secondary circuits. The author considers the frequency as constant and the reactances of the primary and secondary circuits as well as the mutual reactance as the independent variables. He gives the formula which must be fulfilled so that the condition of the greatest maximum value of the current in the secondary circuit may be attained.—*Phys. Review,* April.

Induction Generators.—P. Bunet.—In the second part of his long article on synchronous and non-synchronous alternators the author discusses the induction alternator and shows that it

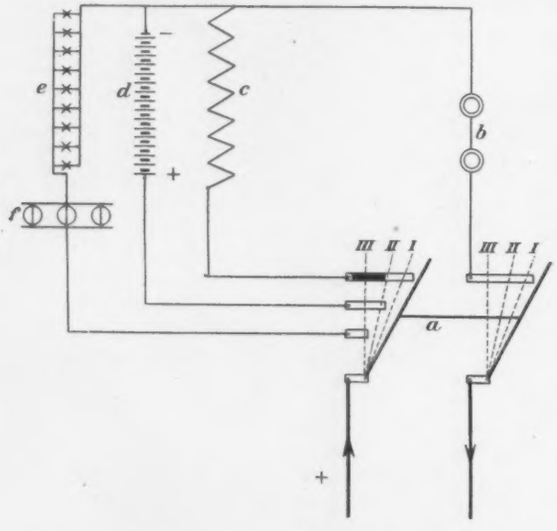


Fig. 1—Arrangement Showing Arc Lamp and Incandescent Lamps on Same Circuit.

overcomes various inconveniences in the use of synchronous alternators. He thinks that the use of induction alternators will largely increase, but that the development will be somewhat delayed by the great development which the synchronous alternators have already undergone in spite of their inconveniences. —*L'Industrie Elec.,* April 10.

Damping Noises of Machines.—W. Gerb.—An illustrated article in which the author describes a method of damping the disturbing noises of revolving machines by attaching to the base of the machine an oscillating system in which the vibrations are absorbed in columns of elastic plates.—*Elek. Zeit.,* April 27.

Lamps and Lighting.

Arc Lamps in Series with Incandescent Lamps. —W. Schaeffer.—A paper read before the Berlin Electrical Society (Verein). The author discusses the possibility of substituting incandescent lamps for the series resistors usually employed with arc lamps and the possibility of employing a single arc lamp together with incandescent lamps on 110-volt circuits or less than four arc lamps with incandescent lamps on 220-volt circuits. To be successful any such arrangement must fulfil the following conditions: The voltage and current for the arc lamps must be variable; the incandescent lamps must get constant current and constant voltage; finally, any disturbances in the arc lamps must not reach the incandescent lamps. The author shows that this is practically fulfilled in the arrangement shown in Fig. 1, in which two arc lamps *b* are connected to a 220-volt circuit; *c* is a resistor; the polarization cells *d* consist simply of lead plates without active mass in dilute sulphuric acid with specific gravity 1.8. The action of these polarization cells is similar to that of a storage battery, but they are not able to give any appreciable current for any length of time. *e* indicates several incandescent lamps and *f* "variators" (like the ballast used with the Nernst lamp—that is, iron-wire resistors in a hydrogen atmosphere). In connecting the lamps to the circuits the switch is first brought to position I, when the arc lamps are supplied with current and are in series with the resistor *c* just as in the ordinary operation of arc lamps. The switch is then turned over to position II, in which the polarization cells *d* are connected in parallel with the resistor *c*. Finally the switch is turned to position III, in which the system of incandescent lamps *e* together with their variators *f* is now in parallel with the polarization cells *d* and this system of parallel-connected circuits is in series with the arc lamps *b*. The resistor *c* is now disconnected from the circuit. Results of tests are given. The paper is to be concluded.—*Elek. Zeit.,* April 27.

Ratio of Light to Illumination.—H. T. Harrison.—A paper presented before the (British) Illuminating Engineering Society. The author considers light as that which causes illumination, whether that illumination is visible or not. He agrees with Trotter's definition of illumination as depending simply on the quantity of light falling upon a surface and that it has nothing to do with the color or reflecting value of that surface. Therefore, it would be, strictly speaking, inaccurate to state that an instrument such as the lumeter indicates the illumination except when it is pointed at a white screen of similar material to the screen in the instrument itself. To demonstrate his point the author has carried out the following experiments with his "universal" photometer. By replacing the standard comparison screen in the instrument by various tinted wall papers, the increased illumination necessary in order that the rays reflected from such wall papers should have the same effect on the eye as when a white paper of similar surface to the photometer screen is used can be ascertained very accurately. The results are as follows:

Color.	Increased Illumination Necessary (Times).
Bright red	3.5
Dull cardinal red	6.5
Medium blue	4.8
Light blue	3.2
Dark green	7.0
Light green	2.2

Another interesting point that these tests prove is that the angle of incidence of the light rays closely follows the cosine law over the greater part of the angular movement, despite the fact that the surfaces of these wall papers were far from plain. The next experiment was to ascertain the value of the light reflected from the area of these papers compared with that from white blotting paper, and, though these tests were made under very different conditions and very roughly, they corroborated the figures given above, thus proving that an instrument of the lumeter class measures correctly the irregular reflecting value of a surface. The author further deals with terminology of lighting, and suggests the following definitions: "Light" = the emanations from a light source. "Illumination" = the extent to which anything is illuminated; foot-candles. "Brilliancy" refers to a primary light source and is candle-power divided by area. "Intrinsic brilliancy" = candle-power per unit surface (square centimeter). "Brightness" and "intrinsic brightness," same as brilliancy. "Luminosity" or "luminous

intensity," same as brilliancy, but applied to secondary sources of light. The author finally discusses the use of reflectors with lamps, but emphasizes that shadowless illumination is always depressing, just as a day when the sun is obscured by clouds is depressing. He claims that it would be wise to deliberate carefully before any system of shadowless illumination is adopted, and to remember that the object of all illumination is to produce an effect by which the outlines of objects are easily seen, which result is greatly assisted by the contrast of light and shade.—Lond. *Electrician,* May 5.

Visibility of Radiation.—P. G. NUTTING.—Radiation of wave-length 0.61μ (orange red) must be twice as intense as radiation of wave-length 0.54μ (in the green) to produce the same luminous impression. Similarly radiation in the red at 0.65μ or in the blue at 0.47μ must be ten times as intense to produce the same illumination as in the green. By determining the intensities of radiation necessary to produce equal luminous sensations for a number of wave-lengths a complete curve may be obtained having a single maximum in the green and sloping off toward the extreme red and violet. This curve gives the visibility of radiation of the various wave-lengths. König investigated the visibility of radiation for his own eye, a normal trichomat, for nine different luminous intensities ranging from the threshold of vision up to about 600 meter-candles per square millimeter of pupil opening. The author has recalculated König's data on visibility, making a certain correction which had not formerly been applied.—*Bull. Bur. of Standards,* May 15.

Long Waves from Quartz Mercury Lamps.—H. RUBENS AND O. VON BAEYER.—An account of an experimental investigation in which the authors prove the presence of extremely long waves from quartz mercury lamps. Heat rays of a wave-length of about 0.3 mm may be extracted from the radiation of the mercury lamp in sufficient force to permit an investigation of their qualities. The infra-red spectrum thereby sustains another enlargement of one and one-half octaves. This long-waved radiation is not emitted by the quartz walls, and it is highly probable that it originates in the luminous mercury vapor.—*Phil. Mag.,* May.

Binocular Photometer.—H. Kruess has arranged the well-known photometer of Lummer and Brodhun for use as a binocular instrument. According to tests of Steigler the percentage error when one eye only is used for a photometric test is generally more than 2 per cent, while with the use of both eyes the error decreases below 1.5 per cent.—*Zeit. f. Instrumentenkunde,* Vol. 30, 1910, page 329; abstracted in *Elek. Zeit.,* April 20.

Generation, Transmission and Distribution.

Three-Phase Autotransformer.—P. GIRAULT.—The three coils, P_1, P_2 and P_3, of a three-phase autotransformer are connected in delta, as shown in Fig. 2, the three points 1, 2 and 3 of the triangle being connected to the three conductors of the three-phase supply line with the effective voltage of u. The points m_1, m_2 and m_3 are the centers of the three phases. This

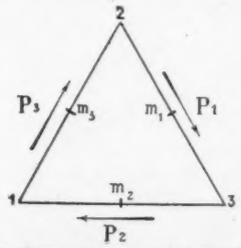


Fig. 2—Three-Phase Autotransformer.

arrangement gives three systems of supplying three-phase currents at $\frac{1}{2}$ u volts, namely, first, m_2 1 m_3; second, m_3 2 m_1, and, third, m_1 3 m_2. The author considers in detail the phase relations of the currents and voltages and the transformation of energy in three cases, namely, if the three systems just mentioned are all loaded or only two are loaded or only one is loaded. The article is illustrated by numerous diagrams and the fundamental formulas are given.—*L'Industrie Elec.,* April 10.

Cranes.—R. BOYLE.—A paper read before the Institute of Engineers and Shipbuilders in Scotland on large motor-driven cranes, with special reference to electric revolving cantilever cranes. The high efficiency of the modern cantilever crane is largely due to the use of electric motors. The introduction of the electric motor has made it a success, which steam and hydraulic motors could never have done. The various units in the driving system may now be quite separate and disconnected, and may be placed in the position of greatest advantage. The problem of electric braking is discussed and a summary is given of the typical equipment of 150-ton to 200-ton cranes.—Lond. *Electrician,* April 28.

Northeast Coast of England.—The fifth of an illustrated serial on electric-power developments on the northeast coast of England. The present article deals with substations. There are several hundred of them, and the principal typical forms are described and illustrated.—Lond. *Eng'ing,* May 5.

Installations, Systems and Appliances.

Electrical Industry in Italy.—The depression in many industries, especially in the cotton industry, prevailing in Italy has had a bad effect on electric-supply systems. For the first time since it was founded the Societa Lombarda, in Milan, has not increased its connections. The company will not increase its present plant and it seems certain that if hydroelectric plants continue to be built at the present rate in northern Italy there will soon be an overproduction of electrical energy in Lombardy. There will soon be available in this district not less than 350,000 hp of hydraulic plants, and it is not yet known what to do with more than 100,000 hp which is now being developed. The tendency of the large generating companies is at present not to sell the energy directly to their customers, but to found subsidiary companies which distribute energy over smaller districts. For instance, the Societa Elettrica Riviera di Ponente has seven subsidiary companies all along the Riviera coast. The Conti Company has twenty subsidiary companies. A greater increase in the use of electricity seems to be imminent in central and southern Italy, especially in Sicily, where quite an unexpected demand for electric light has arisen and electric motors will be used in the sulphur mines. In nothern Italy the hopes of the electrical companies are based on the extension of electric traction on main roads, but this development is getting along slowly. Moreover, competition is very active and prices are very low.—*Elek. Zeit.,* April 27.

Day Load for Central Stations.—J. B. C. KERSHAW.—The first of a series of articles in which the author intends to suggest new sources of day loads for electric-service stations. In the present article he deals with the recovery of iron from the waste metals in brass and iron foundries by means of electromagnetic separators, a few simple types of which are sketched in general. This method will pay only in those foundries where the value of iron recovered (or of the waste material free from iron) is greater than the running and fixed charges of the installation. Cupola slag and ashes contain on the average 10 per cent of iron; molding sand contains 6 per cent. Taking these percentages as the basis of calculation, it is a simple matter to estimate what will be the total value of the recovered iron for any particular foundry, and what expenditure might be safely incurred upon an electromagnetic machine for dealing with the products containing iron. In brass foundries the problem is different, for here the value of such a method lies chiefly in the ease and completeness with which brass filings, borings and turnings, etc., may be freed from the admixture of iron which sometimes greatly reduces their value. In the majority of cases it will, therefore, pay to install such machines in brass foundries without any regard to the price to be obtained for the recovered iron.—Lond. *Elec. Review,* May 12.

Electrophysics and Magnetism.

Pressure Shift of Arc and Spark Lines.—H. G. HALE AND

W. S. Adams.—An abstract of a paper read before the American Physical Society. In examining the spectrum of the sun's limb Adams has found that the enhanced lines (lines stronger in the spark than in the arc) are shifted toward the red, presumably by pressure, markedly more than the arc lines. The authors' present investigation was undertaken to see whether or not laboratory plates would show a greater pressure shift for the enhanced lines than for the arc lines. Many photographs of a powerful spark under pressures varying up to 300 lb. were taken. These were compared with photographs of the arc of titanium under pressure. Differences in the displacement of the arc lines and the spark lines with pressure were established. The authors suggest a hypothesis of the variation of pressure displacements with temperature.—*Phys. Review,* April.

Electrification of Air Near Water Falls.—W. A. D. Rudge.—An account of measurements of the electrification of the air near the Zambesi Falls in South Africa. The potential gradient in volts per meter was measured at different distances from the falls. At a distance of 1000 paces it was 1700 volts per meter, at a distance of 900 paces 2400, at a distance of 700 paces 3500, and at a distance of 500 paces 5000. At the edge of the falls the potential gradient, if it increased at the same rate, would have been enormous, but no doubt in the cloud itself there would be some conduction going on (certainly convection). From the rate at which the electroscope leaves diverged to a maximum, the charge at the falls would be twenty-five times as great as that at a distance of 1100 paces, namely, 25,000 volts per meter.—*Phil. Mag.,* May.

Polarization of Roentgen Rays.—F. C. Miller.—Ham has formerly investigated the polarization of Roentgen rays from an anti-cathode of lead. The present author has studied them from an anti-cathode of silver and the results show that practically no difference exists in the polarization of Roentgen rays from a lead target and a silver target.—*Jour. Frank. Inst.,* May.

Electrochemistry and Batteries.

Structure of the Atom.—E. Rutherford.—The well-known fact that the alpha and beta particles suffer deflection from their rectilinear paths by encounters with atoms of matter is used by the author to study closely the nature of these deflections and to derive therefrom some idea of the constitution of the atom to produce the effects observed. He considers an atom which contains a charge $\pm Ne$ at its center surrounded by a sphere of electrification containing a charge $\mp Ne$ supposed uniformly distributed throughout a sphere of radius R. e is the fundamental unit of charge, which is taken as 4.65×10^{-10} e. s. unit. It is further supposed that for distances less than 10^{-12} cm the central charge and also the charge on the alpha particle may be supposed to be concentrated at a point. On this basis he gives the theory of the deflection of alpha particles and compares the theory with experimental results. The general data available indicate that the value of the central charge of Ne for different atoms is approximately proportional to their atomic weight, at any rate for atoms heavier than aluminum. The deductions from the theory so far considered are independent of the sign of the central charge, and it has not so far been found possible to obtain definite evidence to determine whether it be positive or negative.—*Phil. Mag.,* May.

Units, Measurements and Instruments.

Measuring Susceptibility.—C. E. Mendenhall and W. F. Lent.—An abstract of a new method for measuring the susceptibility of weakly magnetic substances. The principle of the method is to balance the torque produced by the action of a non-uniform magnetic field upon two symmetrically placed specimens of the substance under test by the torque due to the action of the same field upon coils immediately surrounding the specimens, the current in which can be measured. The general arrangement of the apparatus is shown in Fig. 3, where N, S are the poles of the magnet producing the testing field; S_1 S_2 the small cylinders of the metal under test; c_1 c_2 the cylindrical coils accurately surrounding the test specimens through which the balancing current is passed, and w_1 w_2 the suspending wires, which also serve to carry the current to and from the coils c. The method is applied to a study of the susceptibility of alloys of bismuth with tellurium and thallium with the following results: The mean value for the susceptibility $k = 14.32$ is obtained for pure bismuth. Preliminary results of the effect of heat-treatment (crystal structure) on the susceptibility of bismuth are given. The curves connecting k and percentage composition for the series of Bi-Te alloys is given, showing no peculiar magnetic properties for the compound Bi_2Te_3. The corresponding curve for Bi-Th alloys is also determined and does show peculiar magnetic properties for the compound Bi_2Tl_3.—*Phys. Review,* April.

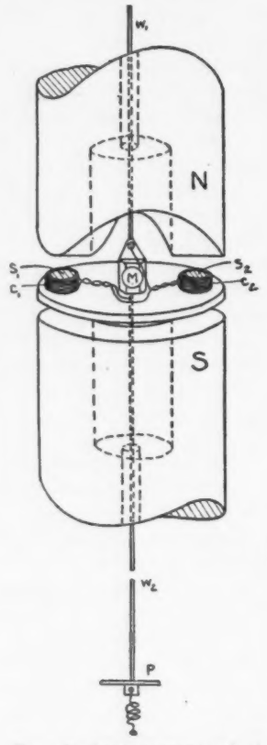


Fig. 3—Arrangement of Apparatus for Measuring Susceptibility.

American Testing and Research Laboratories.—F. Laporte.—An abstract of his report on his visit to various electrical laboratories in the United States, where the laboratory is stated to be the faithful auxiliary of the industry and to develop with it. First, the Bureau of Standards is mentioned and its equipment described. The generosity of the government in providing funds is pointed out. A comparison is made as to the number of tests and the prices charged for them between the Bureau of Standards and the Central Laboratory of Electricity in Paris. In the two sections of electricity and photometry 4389 tests were made in 1910 at a cost of $7,254 at the Bureau of Standards in Washington, while in the same year at the Central Laboratory of Electricity in Paris 1170 tests were made at a cost of $11,800. The equipment of the Electrical Testing Laboratories of New York is next described and the attention paid there to ventilation is especially pointed out. From the research laboratory of the General Electric Company in Schenectady the author got the impression of a certain scantiness (exiguité) of installation, but at the same time one of extraordinary activity. Reference is made to the use of wooden buildings in spite of the presence of electric furnaces. With respect to the laboratory of the National Electric Lamp Association in Cleveland the automatic feature of the manufacture and test of tungsten lamps "with an activity worthy of note" is pointed out.—*Bull. Soc. Internat. des Elec.,* March; abstracted in *La Lumière Elec.,* April 29.

Electric Resistance Thermometer.—C. F. Marvin.—A paper read before the Franklin Institute in which the author describes exact methods by which manufacturers of electric instruments can construct resistance thermometers so as to indicate temperatures on the gas scale directly and thus avoid the necessity of the trouble of the conversion tables commonly employed. The method consists in a combination of a resistance thermometer with a Wheatstone bridge, four different arrangements being shown. By exercising a proper choice in the manner of connecting up the bridge and of the resistance in the arms, the bridge scale can be fitted to almost any kind of resistance thermometer, whether its resistance changes with temperature by a linear law or according to some curve, convex either upward or downward. The general formulas are given and some numerical examples are added.—*Jour. Frank. Inst.,* May.

Measuring the Insulation Resistance of a Bundle of Insulated Conductors.—R. LAUTRÉ.—The author points out that there is a certain difference between the usual tests of the insulation resistance of bundles of insulated conductors and the specification for insulation resistance. That is, the insulation resistance measured is not exactly the one referred to in the specifications. To overcome this difference the author describes a number of simple measurements and recommends that in the specifications it should be exactly stated what test should be made.—*La Lumière Elec.*, April 29.

Induction Meter.—An official communication of the Reichanstalt by which a single-phase induction meter for two-wire and three-wire networks at 100 volts to 250 volts with currents from 3 amp to 75 amp made by Keiser & Schmidt is admitted for calibration. The construction is described and illustrated and the method of calibration discussed.—*Elek. Zeit.*, April 20.

Meters.—W. LUBACH.—An English translation of his recent German paper on developments in the last years in the manufacture of electric meters.—Lond. *Electrician*, April 21.

Telegraphy, Telephony and Signals.

Measurement of Electric Oscillation in Receiving Antenna.—L. W. AUSTIN.—The perikon detector can be standardized by comparing it with a thermo-element in a circuit to which it is coupled. If the thermo-element is calibrated so that the numerical value of the oscillating currents in the second circuit is known, then for the given conditions of frequency and coupling the perikon may be used for quantitative measurement of very small currents in the circuit to which it is coupled. This method has been developed for use in determining the numerical value of the currents in a wireless antenna when signals are being received. The arrangement of the apparatus is described and results of tests are given.—*Bull. Bur. of Standards*, May 15.

Miscellaneous.

Removing of Electric Charges in Textile Mills.—PAILLET, F. DUCRETET AND E. ROGER.—An abstract of a French Academy paper. In the different phases of the manufacture of textile materials like wool, silk, cotton, etc., electrostatic charges due to friction often cause considerable trouble. For instance, in spinning wool the charged threads will diverge and a considerable portion will detach from the principal mesh. There is, therefore, a considerable loss. To overcome this trouble the air is usually artificially loaded with moisture, but this is a bad remedy from the standpoint of sanitation, since all ventilation is impossible, double windows are used, and the shops are overheated. In experiments made at Fourmies in the factory of Paillet it was found that the electric charge could be neutralized simply by using high-frequency, high-tension currents such as have been used in electrotherapeutics according to the method of D'Arsonval and more recently in wireless telegraphy. Since the use of these currents is not offensive, it is possible to use a large amount of energy without any danger for the workingmen. In the process which they employ and which has been in regular operation since May of 1910, use is made of the oscillating discharge of condensers which are supplied with an alternating current, the voltage of which is raised by means of a transformer. The arrangement which has given the best results is known under the name of "Oudin resonator" in wireless telegraphy. The aerial wires or antennas are stretched along the frames near the textile matter under treatment. The results obtained have been officially confirmed. The elasticity of the product has been raised by 19 per cent. The waste has been decreased from 23 per cent to 28 per cent. The windows of the factory are now open and the shops well ventilated.—*L'Industrie Elec.*, April 10.

American Plants.—A. GERARD.—Brief descriptions of the Schenectady works of the General Electric Company, of the Westinghouse Works in Pittsburgh, and some notes on a few electrochemical plants at Niagara Falls from the observations of the author during a trip through this country.—*La Lumiere Elec.*, April 29.

BOOK REVIEWS.

DIE NORMALEN EIGENSCHAFTEN ELEKTRISCHER MASCHINEN. By Rudolf Goldschmidt. Berlin: Julius Springer. 68 pages, 34 illus. Price, 3 marks.

A tabular and diagrammatic critical analysis is here given of the properties and limitations of electrical machinery. It is clearly and simply drawn up for engineers and students of machinery. It employs practically no algebra and depends upon tables and curves to present the facts. The book is divided into nine chapters on the following subjects: Direct-current machines, converters, synchronous alternating-current machines, asynchronous motors, single-phase commutator-motors, transformers, efficiencies of electrical machines at underloads and overloads, power-factor of induction motors at underloads and overloads, intermittent service loads. The book will be useful to electrical engineers who desire to compare standard German construction with United States construction in electrical machinery. It is evidently not intended to delimit the possibilities of construction in special machines.

MANUALE DELL' INGEGNERE ELETTRICISTA. By Ing. A. Marro. Milan: Ulrico Hoepli. 862 pages, 254 illus. Price, 8½ lire.

This is the second revised and enlarged edition of an excellent manual for the electrical engineer. The book is divided into eighteen principal sections on the following topics: Elementary principles, units of measures, electric and magnetic constants, methods and instruments of measure, generators, storage batteries, transformer motors, lamps, distribution systems, conductors, central stations, transmission lines, operating rules, legislation, electric traction, special applications. Although somewhat heavy for a pocket book, the manual is conveniently arranged for reference. It contains many important formulas and diagrams of connections. Arithmetical tables are appended at the end. The book will be useful to electrical engineers and students familiar with Italian.

SMOLEY'S TABLES. By Constantine Smoley, C.E. New York: The Engineering News Publishing Company. 171 pages. Price, $3.50.

This is the sixth edition of a handy set of municipal tables particularly useful to architects, artisans and artificers. Its purpose is largely connected with overcoming the difficultes of the English system of lengths as given in feet, inches and sixteenths of an inch. In the metric system the book would to a large extent be rendered unnecessary, so that it constitutes a monument to the metrological inefficiency of the English-speaking peoples. Nevertheless, the utility of the book as a ready reckoner in the swamps and quagmires of our English measures is indisputable. The type is well selected, the tables are well arranged, and excellent examples are offered with each to show their method of application. The tables will be of particular use to foremen builders.

ELECTRICIAN'S OPERATING AND TESTING MANUAL. By H. C. Horstman and V. H. Tousley. Chicago: F. J. Drake & Company. 360 pages, 211 illus. Price, $1.50.

This manual for the practical electrician, written by practical men of wide electrical experience, one of whom is chief inspector for the city of Chicago, contains information useful to those installing, testing and repairing the more common kinds of electrical apparatus. While this practical material shows excellent selection in the subjects treated, the arrangement and discussion is not always most clearly or simply presented. Loose use of terms and units is also indulged in to an extent that may prove confusing to one seeking a correct understanding of electrical quantities. The workman, to whom the book is addressed, however, will be sure to find much of an instructive nature in the illustrations and diagrams with which the manual is profusely furnished.

Notions Fondamentales sur la Télégraphie. By Albert Turpain. Paris: Gauthier-Villars. 180 pages, 122 illus. Price, 5 francs.

The book is addressed to elementary students of telegraph engineering. It describes in a direct and simple way the apparatus and processes employed in ordinary land telegraphy, especially in France. An introduction of fifteen pages is devoted to a brief history of the telegraph. The book is then divided into three sections. The first relates to simple telegraphy, the second to multiple and multiplex telegraphy and the third to the future probable development of the art. An elementary physical theory is outlined along the lines of Lord Kelvin's original treatment of a single signal.

The work will be of interest to electrical engineers desiring to acquaint themselves with French telegraph apparatus and systems.

La Théorie des Courants Alternatifs. By Alexander Russell. Paris: Gauthier-Villars. Vols. I and II. 1010 pages, 342 illus. Price, 33 francs.

This work has been translated into French from the original English by M. G. Séligmann-Lui. The translation is in itself an excellent piece of work, because in style and language the book reads very largely as though it had been thought out in French. Aside from the matter of translation, the book must be considered as an English original. As such it is probably the best work on alternating-current theory that England has yet produced. Books on that subject equally masterful in style have been written by other writers in the past, but at a date when alternating currents had received but little practical development.

It is strange, considering the many technical questions discussed mathematically in this textbook, that so little use should be made therein of vector methods explicitly. Corresponding discussions in this country would be dealt with by the use of complex quantities to a considerable extent at least. In this respect the book is well adapted to the needs of French engineering students, who, as a rule, do not lay much stress on vector methods of demonstration. The work will be of great value to advanced students of alternating-current electrical engineering, either in the French or in the original. Volume I deals mainly with the principles of alternating currents and their properties, while Volume II treats of alternating-current machinery and energy transmission.

Elektrizitat aus Kehricht. By Etienne de Fodor. Budapest: Julius Benko. 224 pages, 169 illus.

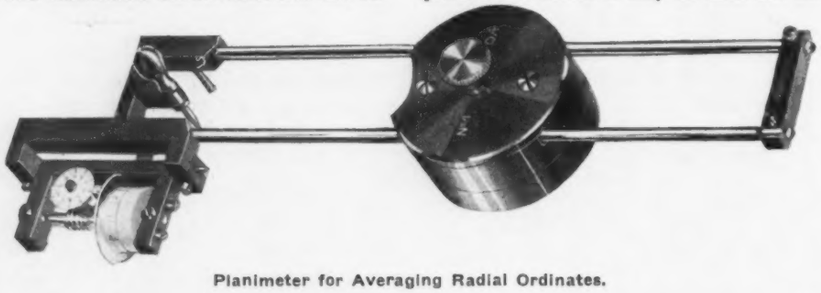
In this work Mr. Etienne de Fodor, general manager of the Budapest General Electric Company, deals in a most interesting way with the subject of refuse destruction as related to central stations. Mr. de Fodor has given this subject much attention for some years, studying nearly all of the most important plants that exist or are under construction. The work contains not only valuable data for the engineer, but also abundant general information for all interested in the subject of refuse destruction. From the many original illustrations contained it is readily apparent that the development of power from refuse destruction is making much progress abroad. The erection of plants was at first principally confined to England, where nearly all of the pioneer work has been done, and where most of the existing plants are located. Germany, however, has of late years taken up the manufacture and erection of such plants. After English concerns had erected plants at Hamburg, Brussels and Zürich, brisk competition from Germans developed, but, owing to improvements in construction, English manufacturers are again in the front and lead as formerly.

The book, which includes numerous illustrations, is divided into twelve chapters treating the following subjects: I. The disposal of refuse. II. Refuse destruction. III. Development in refuse destruction. IV. Refuse-destruction development on the Continent V. Refuse-destruction furnaces as generators of energy. VI. Assorting and refuse-destruction combinations. VII. Further developments in refuse destruction. VIII. The mechanical feeding of refuse furnaces. IX. Steam generation from refuse. X. Utilization of by-products. XI. Refuse transportation to destructor plant. XII. The location of destructor plants

New Apparatus and Appliances

PLANIMETER FOR AVERAGING RADIAL ORDINATES.

The accompanying illustration shows a type of planimeter designed to give the mean value of ordinates in the circular diagram—a feat impossible with the ordinary form of planimeter, which gives the mean square of the ordinates rather than the mean ordinates. The instrument shown embodies the following geometrical elements: A base which is centered with the diagram or chart to be averaged and carrying a pair of parallel guide slots; a pair of rods working in the slots of the base and carrying at their end a frame to which is attached a tracing point and a pivoted carriage for the integrating wheel, and the integrating wheel for measuring the record. The line joining the tracing point with the center of the base determines the radius vector at any one instant. The axis of the integrating wheel is parallel with this line and the record counted on the wheel is proportional to the product of the average radius vector multiplied by the angle through which the radius vector is carried. Hence, by dividing the reading by the angle the mean radius is obtained. The instrument is graduated to give the mean ordinate in linear inches, so that by applying the appropriate scale factor it may be used for all diagrams, no matter what is the character of the quantity recorded. The limits for the movement of the tracing point are from a circle of 1.5 in. in diameter as a minimum to a circle of 10.5 in. in diameter as a maximum. The instrument above described is made by the well-known Swiss firm of Amsler, Laffre & Company, the pioneers in the manufacture of planimeters, and was designed by

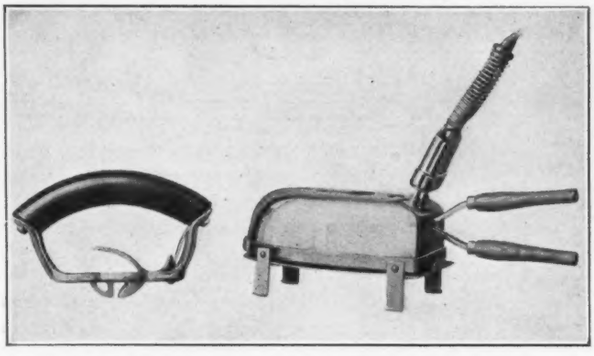


Planimeter for Averaging Radial Ordinates.

Prof. W. F. Durand, Leland Stanford, Jr., University, Palo Alto, Cal.

THE TRAVELER'S ELECTRIC IRON.

Often the traveler has occasion to do light pressing in his or her room. Creases in garments that come from packing must be eliminated, the effects of damp weather must be removed and often dainty linen must be pressed. An electric iron is invaluable for these services, but, for the traveler, an iron should be



Traveler's Electric Iron with Handle Removed.

so designed that it can be packed readily and it must be thoroughly reliable. The iron shown herewith is arranged so that the handle can be removed, and hence a minimum of packing space is necessary. The heating element is inclosed under enormous pressure between the bottom ironing face and a top casting which constitutes a heat reservoir and which is thermally insulated from the sheet-metal cover by an air space. This construction prevents oxidization of the element, hence it will last indefinitely. No breakable material enters into the construction of the iron. Neither porcelain, lava nor molded asbestors, all of which are brittle, is used in this iron or in its plugs. All insulation is of sheet mica and the connecting plug is composed wholly of metal and sheet mica. In the end of the iron there is a hole in which a curling iron can be heated. This iron is made by the Westinghouse Electric & Manufacturing company.

OIL-BREAK SWITCH FOR MANHOLE SERVICE.

It is oftentimes desirable to install an oil-break switch in a manhole or other location where obviously the ordinary type of oil-break switch is not adapted owing to danger of flooding. To meet this end the General Electric Company has developed a water-tight oil-break switch substantial in construction and suited to operation on circuits up to 7500 volts, in which the normal current rating is 200 amp or less.

These switches are made in non-automatic form, single-pole, double-pole and triple-pole, single-throw. The frame cover and oil vessel are of cast iron and all joints are made water-tight by means of gaskets. The frame is provided with a large vent hole to which a pipe may be connected and extended above the water line to prevent undue strain on the gaskets, due to gases generated when the switches are opened under load. The operating handle is outside the frame and can be operated by hand or by a hook. The shaft to which the handle is attached passes through the frame in a water-tight stuffing box. The leads are carried to and from the switch through the bottom of the frame, water-tight bushings being provided for this purpose on the frame.

The double-pole and triple-pole switches are so arranged that each lead may pass through a separate outlet, or one outlet may be used in each end of the frame for double or triple conductor cable.

The stationary contacts consist of flared fingers of drop-forged copper supported from the contact blocks of the current-carrying copper studs by heavy flat steel springs. The studs are supported and insulated from the frame by poreclain insulators. The movable contacts are wedge-shaped copper blades actuated by specially treated wooden rods connected to the cross-head, which in turn is operated by the handle and actuating mechanism. The construction of the stationary and mov-

Oil-Break Switch for Manhole Service.

able contacts is such that the arc is ruptured between the flared portion of the stationary and the upper extremity of the movable contacts protecting the actual contact surfaces. This form of construction insures clean contact surfaces, uniform contact under pressure and does not retard the opening of the switch.

CLAMPS FOR VERTICAL WIRES.

The clamp shown in the accompanying illustration has been developed for tying vertical wires to the ordinary type of line insulator. The arrangement of the device is self-evident from the illustration. The clamp can be put on the insulator and

Clamp with Vertical Wire in Place.

placed around the wire without removing the bolt, so that the minimum of time is consumed in erection. It readily adjusts itself to various sizes of wires and cable up to and including duplex-arc cable 1.25 in. in diameter. This clamping device has been put on the market by Henry J. Blakeslee, 603 South Crouse Avenue, Syracuse, N. Y.

WIRE-SKINNING TOOL.

To remove insulation from a wire by the use of a knife is slow and tedious and often endangers the operator or work by the knife's slipping and cutting the hand or nicking the wire so that the latter may break at some important connection. A tool recently marketed by Mathias Klein & Sons, 562 West Van Buren Street, Chicago, is illustrated in the accompanying sketch and consists of a steel-spring handle with specially constructed cutting edges for separating duplex wire, splitting insulation and scraping wire. The largest pair of twin cuts is used for splitting duplex wires. The small teeth at the center of the tool may be used for splitting the insulation on a single wire without damaging the copper within. By means of the parallel scraping jaws the insulation may then be drawn off and the copper scraped

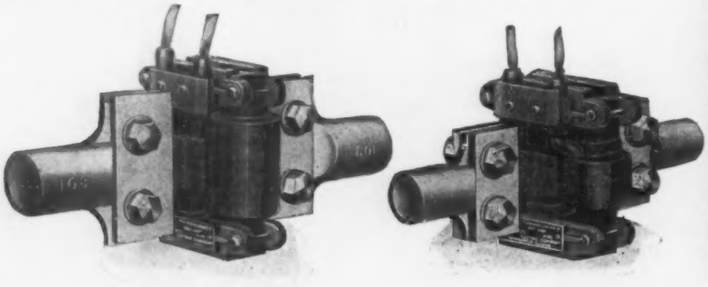
Wire-Skinning Tool.

clean, ready for soldering. The tool can also be used for stripping the braid insulation from lamp cord with a single pull. For this purpose the small or middle teeth are used without injuring any of the strands of the cord. The tool is made of tempered steel, nickel-plated and is practically indestructible. It measures 3½ in. long x 1½ in. wide, so that it is adapted to be carried in the pocket.

SERIES INSTRUMENT TRANSFORMERS

As the usefulness of the series transformer is more generally appreciated its application is steadily increasing, especially for service in conjunction with measuring instruments, as it permits a range of measurement that cannot be secured with self-contained instruments. Aside from the flexibility of measurement, the series transformer also secures a factor of insulation impossible with self-contained instruments and this fact alone is of sufficient importance to warrant its more general application.

The requirements of modern metering necessitate the use of series transformers having an accurate ratio of transformation, as otherwise it would be useless to employ a meter having high accuracy and then impair the reading or registration by using a series transformer of such characteristics that it had a poor ratio curve. The type of series transformers illustrated herewith is such that the transformer can be conveniently mounted on the switchboard or other support without entailing expensive busbar construction and the appearance



Series Instrument Transformers.

conforms to other high-grade switchboard appliances. The coils closely fit the iron core, which is held in position by locking clamps, thus securing a construction which is permanent. In the larger sizes the busbar itself forms the primary, the secondary winding in all sizes being wound for 5 amp.

Heavy clamping contacts are provided of sufficient area to carry full load continuously without heating and heavy intermittent loads without damage. The 5-amp leads are brought through porcelain bushings. The various elements are arranged so that a permanently high insulation value will be maintained under both normal and abnormal conditions. The electrical design is such that the ratio is said to be very accurate on a wide range, thus insuring correct measurements at both light and heavy loads. These transformers are made by the Sangamo Electric Company, Springfield, Ill.

ARTIFICIAL PRODUCTION OF COMMERCIAL LOAD.

Indicating instruments for use on commercial circuits when new and tested under laboratory conditions often show a high degree of accuracy and yet in actual service become unreliable and quite inaccurate. Therefore, in judging the fitness of such instruments it is necessary to have some means of observing their behavior under actual service conditions.

Load fluctuations produce changes in current, emf and frequency and thus they may introduce serious errors in the indications of the instruments. Fluctuations of the current through an instrument cause corresponding changes in the torque, and unless the movable system is sensitive to quick changes it will be sluggish in following a change in load, and if not well damped it will overswing and oscillate about its true position, thus rendering reading difficult.

In connection with an exhibit of Weston alternating-current switchboard instruments now being held in New York City provision has been made for the artificial reproduction of the severe conditions encountered in commercial service. The exhibit includes a full line of indicating instruments for alternating-current switchboards mounted on instrument panels and connected for operation; the individual parts and movements of all these instruments are displayed in showcases, together with a line of portable alternating-current instruments for testing and field purposes.

The connections of the operating equipment are shown in Fig. 3. The power plant consists of two 120-volt, 0.6-kw Eck motor-generator sets. The motors are provided with two rheostats in each field circuit, one for coarse steps and the other for fine adjustment. By this means the speed can be quickly and nicely adjusted over a range corresponding to an adjustment of frequency from 50 cycles to 70 cycles per second and

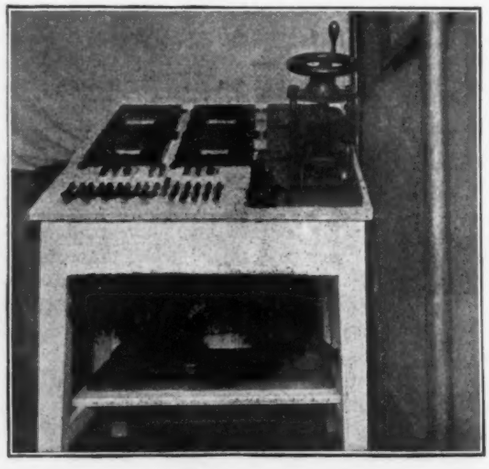


Fig. 1—Bench Board for Control.

the fineness of the adjustment permits accurate synchronization of the machines. The emf of the system may be varied from 50 volts to 150 volts by means of rheostats in the field circuits of the generators.

The load circuit is made up of a reactor and a group of resistors connected in series. The reactor consists of a coil

wound on one leg of an [-shaped core, the bridging leg being mounted on a screw so as to permit adjustment of the air-gap. By means of this adjustment the power-factor may be varied from 0.50 lag to 1.00, where the reactor is short-circuited by a switch. The entire control apparatus, switches, rheostats, etc., are mounted on a benchboard located in front and to one side of the instrument board, as may be seen in the accompanying general view.

Lamp banks were used as resistors because of the small space required in proportion to the power dissipated. Four are connected in multiple, two being joined in series with a home-made flasher, the purpose of which is to cause the load to fluctuate in a non-periodic and irregular fashion. The flasher is operated

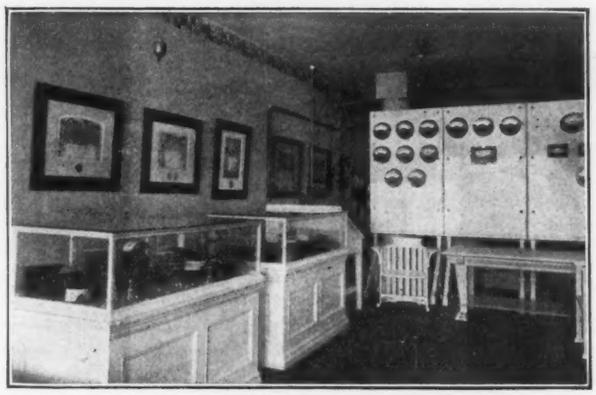


Fig. 2—General View of Exhibit.

by an Eck 0.1-hp motor, illustrated in Fig. 5. The flasher consists of a rotating contact cylinder and an oscillating brush

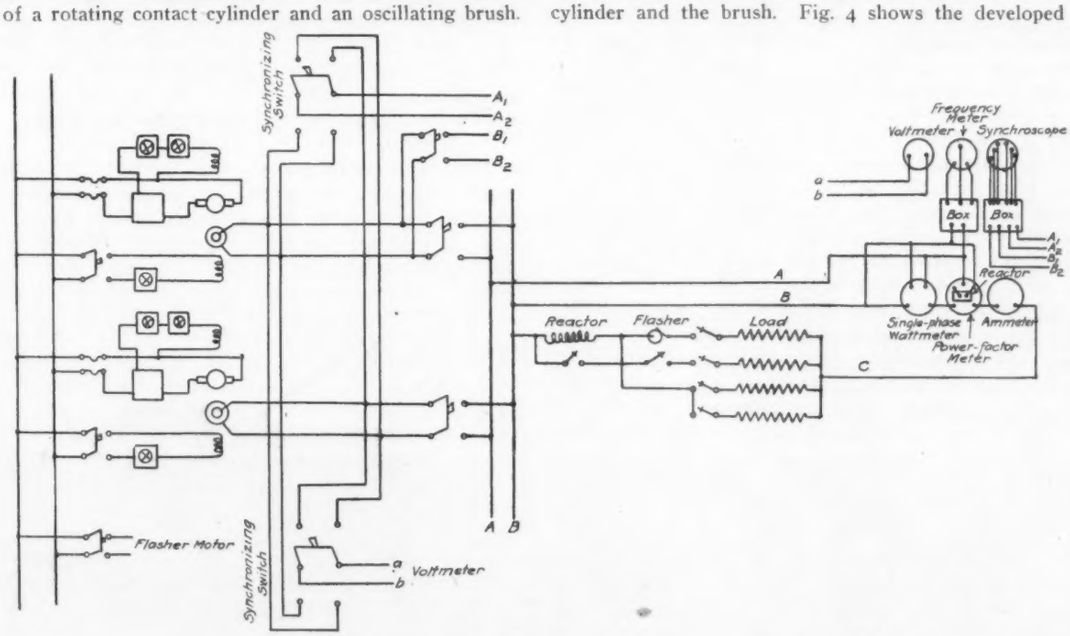


Fig. 3—Diagram Showing Connections of Operating Equipment.

The cylinder is made of wood and is partly enveloped with a triangular sheet of brass connected conductively to the axle,

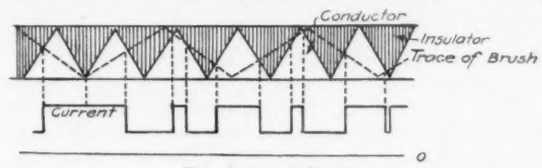


Fig. 4—Load Curve.

against which bears a spring contact. The brush is fitted with a platinum contact and is mounted on a long arm pivoted near one end and arranged to be swung back and forth over the surface of the cylinder by the combined action of a cam and a spring.

The length of time the total load is on the circuit varies

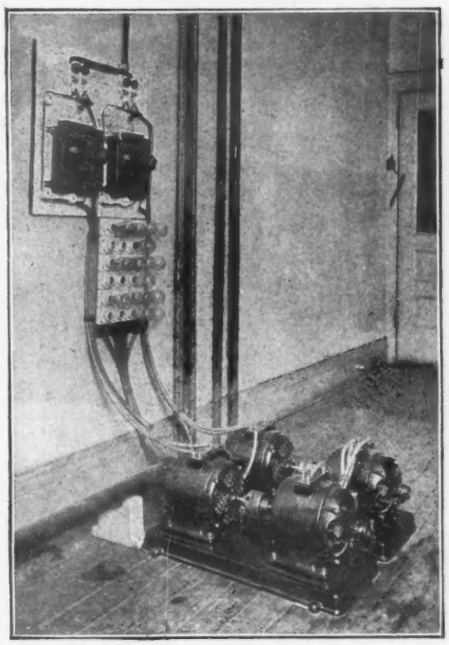


Fig. 5—Power Plant.

continuously and irregularly, due to the combined motion of the cylinder and the brush. Fig. 4 shows the developed path of the brush over the alternate conducting and insulating surfaces of the cylinder; the load curve is constructed from the trace of the brush.

The series coils of the wattmeters and power-factor meters and the ammeter are connected in series with the load reactor and resistors, and the same voltage is impressed across all shunt or potential coils; therefore, the readings of the various instruments should be comparable with each other. For instance, the wattmeter reading should equal the product of the readings of the voltmeter, ammeter and power-factor meter. The synchronizing connections are the same as usual and need no explanation other than that afforded by the wiring diagram, Fig. 3.

DRAWN-WIRE, HIGH-EFFICIENCY LAMP FILAMENTS.

A majority of the incandescent-lamp companies of this country are now using drawn-wire filaments for practically their entire output of high-efficiency lamps, the new construction having been generally adopted for all regular sizes and types, except for the lower wattages in the high voltages (200 volts to 500 volts, 45 watts and 60 watts). That is to say, miniature, train-lighting, low-volt, street-series, compensator and automobile

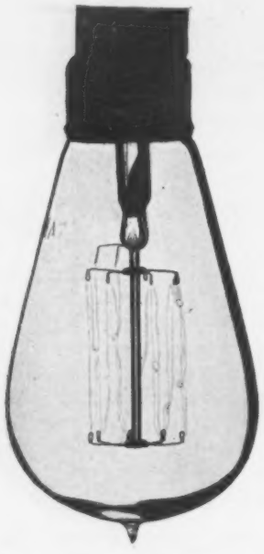


Fig. 1—Tungsten Lamp with Filament Knotted.

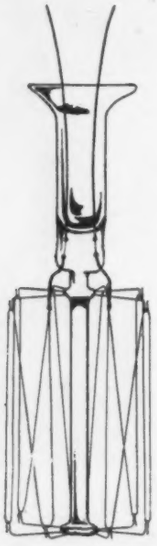


Fig. 2—Mount with Drawn-Wire Filament Before Sealing In.

lamps, as well as the regular 100-volt to 125-volt type, may now be obtained with drawn-wire filaments.

While the new construction does not give a non-breakable lamp it greatly reduces fragility. Metal-filament lamps should still be handled with care both in shipment and in service, as the filament after burning loses some of its mechanical strength.

While this recent advance in lamp manufacture is an important one, the research laboratories are as busy as ever, and there is good reason to suppose that the drawn-wire lamp is the forerunner of even better lamps in the future, although what the next important development will be, and when it will occur, can only be conjectured. It should be added that the new construction does not involve greater ease in the manufacture of metal-filament lamps, since the process of drawing the densest kind of wire down to almost microscopic dimensions, especially when that wire must pass most exacting tests for quality and uniformity, involves a long, costly series of operations and is beset with many disturbing factors, all of which must be watched with great care.

To the public the new method of lamp construction means that the same general methods of filament mounting that have been found so successful in the tantalum lamp have now been made practical for its more efficient rival, and this has been accomplished without entailing the mediocrity of performance on alternating current which was characteristic of the tantalum filament. To the lamp manufacturers the new development signalizes a triumph of invention and research. The metal, which less than a dozen years ago was known in its pure form only as a dense, infusible black powder, is to-day drawn into wires of half the diameter of a human hair. The manufacturer now has a high-efficiency filament material possessing all the desired flexibility and strength when put into a lamp, although, as above intimated, the completed lamps will not withstand football tactics, as burning tends to make them less rugged.

The accompanying picture shows a freak lamp with a large number of loops and knots in the filament, showing how easily it can be bent before mounting. Like many other inventions, the drawn-wire filament has meant and will mean the abandonment of much costly and highly specialized machinery. More than that, it has meant that employees who had become specially skilled in the performance of operations connected with the manufacture and inspection of pressed filaments must now be trained to do entirely different operations, since their skill in the old kind of work has lost its market value. The scrapping of many tens of thousands of dollars' worth of machinery and materials in this departure is an example of the way in which the modern manufacturer tears down in order to progress.

To the electrical jobbers, dealers and contractors all over the country the new lamp will mean less breakage in shipment and in stock. It will be an easier lamp to sell and it will bring a large amount of electrical construction work in residences and other buildings where its introduction will mean the introduction of electric light itself. More fixtures, more reflectors and more of the hundred and one accessories and current-consuming devices will be used.

From the central-station's standpoint the new lamp is sure to have the effect of increasing the number of high-efficiency lamps on the circuits and thus of increasing the average efficiency of all the lamps in service. Thus it brings the high-efficiency lamp problem once more forcibly before the attention of the central-station manager and shows him the necessity for such a public policy as regards rates, publicity, etc., as will enable the central station to share with the consumer the advantages of the saving made possible by the high-efficiency lamps. It will be an effective instrument in the hands of new-business men. To many central stations it will mean that whereas they have not hitherto found it advisable to carry metal-filament lamps in stock or to supply them to their customers, the policy in this respect will be reversed. Its coming means another reduction in the cost of light, another extension of the field in which high-efficiency incandescents are advantageous.

ELECTRIC FIRELESS COOKER.

In the stove illustrated herewith the well-known principle of the fireless cooker is applied in a highly efficient and effective manner. The heat is applied electrically for such a length of time as is required to produce the proper temperature and then the supply of energy is cut off. The stove is thermally well insulated and hence retains the stored energy for cooking the

Fig. 1—Outfit for Two-Oven Stove.

food. It is not necessary to preheat or partially cook the food before it is placed in the stove, and there are no plates to be taken out and heated artificially. The stove is conveniently arranged, compact and self-contained. However, the electric heater of each stove element can be removed at will for frying, toasting or general use separate from the fireless cooker.

The body of the cooker is made of black Russia iron, while the top and bottom trimmings are nickel-plated. The inner

lining is of copper. Between the outer wall of the stove and the inner lining is packed the thermal insulating material, which renders it possible to retain the heat for many hours. The stove is made in the one-oven, two-oven and three-oven styles. The assembly parts of the two-oven stove are shown in Fig. 1, while

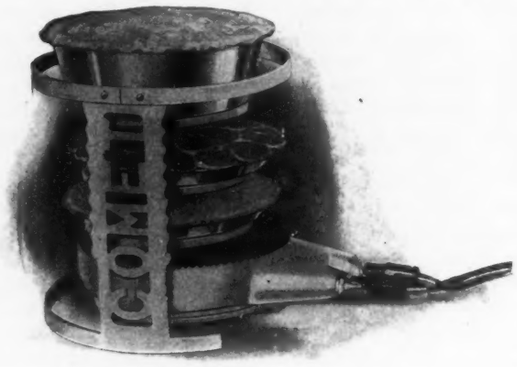


Fig. 2—Baking Rack as It Appears in Use in Oven.

a view of the baking rack in service is given in Fig. 2. These cookers are made by the Comet Electric Stove Company, 280 Eighteenth Street, Detroit, Mich.

THERMO RAIL-BONDING PROCESS.

The Ohio Brass Company, Mansfield, Ohio, has devised a method by means of which the terminals of rail bonds can be soldered to the rails after being compressed in the ordinary way. The process consists of heating the bond terminal after compression and the adjacent web of the rail practically instantaneously by a chemical reaction. The resultant heat is so concentrated that while the terminal and adjacent web are quickly brought to a soldering temperature, the ball of the rail remains cold. The solder enters under the shoulder of the terminal and unites the entire shoulder to the web of the rail, forming a fillet which seals the joint against the entrance of moisture between the head of the bond and the web of the rail and uniting the compressed portion of the terminal to the annular walls of the hole in the rail. The bonding process is covered by patents and its use is strictly limited by the company to the application of rail bonds furnished by it. The illustrations show the application of the bonding process. A clamp spans the rail and holds the thermo cup in position against the head of the bond. In the cup is placed the necessary amount of compound,

Fig. 1—Ready for Ignition. Fig. 2—During Reaction. Fig. 3—Applying the Solder.

on top of which is placed the ignition powder. The resultant chemical reaction of the firing of the charge is accompanied by great heat, enabling the solder to be applied from a spool in the usual manner after the application of a suitable flux.

END-BELLS FOR ALTERNATING-CURRENT GENERATORS.

The sheet-steel end-bell of the Westinghouse alternating-current generator has met with much appreciation for several reasons. Its neat and uniform construction gives a generously

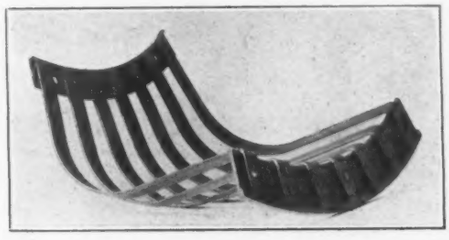


Fig. 1—Detail of End-Bell.

rounded, complete and distinctive appearance to a machine not so well accomplished by the more clumsy and heavy castings. Castings, moreover, are liable to be more or less warped and difficult, if not impossible, to fit nicely with a reasonable amount of work. More important than this reason for changing from cast to sheet material was the constant breakage of the castings in shipment and erection. The necessary number of different designs made it costly to carry large numbers of cast end-balls in stock to avoid delay in manufacture.

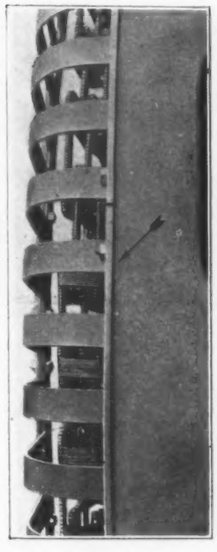


Fig. 2—Application of End-Bell.

Cast end-bells, in order to present a pleasing appearance and avoid interference with development, have to be made in shapes rather delicate for the rough handling they receive. The sheet-steel end-bell, with its ability to withstand mechanical injury, provides an admirable solution of the breakage difficulty. It is securely bolted to the frame at one end and bound together in a continuous circle on the other end. Sheet-steel bells greatly improve the appearance of a machine because the bells are just alike and the material is smooth and uniform, indicating successful design for a specific purpose. The bending strap is of angle iron with one very short flange, just long enough to cover the ends of the ribs. This Westinghouse end-bell is undoubtedly very practical, and it will be found by those using it to be a well-designed device for its purpose in connection with alternating-current generators.

HANDLING COAL IN A MODERN BOILER-ROOM.

An ideal system for handling coal in feeding boilers would enable the coal to be dropped into the bunkers direct from the car or lighter and fed to the grates without rehandling. This

Fig. 1—Coal-Bucket, Hoist and Carriage.

is impossible in any modern city building, or, indeed, in any but a few boiler-rooms enjoying an exceptionally favorable situation. Although boiler-room excavations are carried to greater and greater depth in our cities, there are but few instances in which the coal can be fed to the boiler-room or into the automatic stokers by gravity.

An interesting solution of the coal-handling problems is found in the new Fifth Avenue Building, at the corner of Twenty-third Street and Broadway, in New York City. The boiler-room is located three stories below the street level and the coal supply is carried in bunkers, which are as favorably

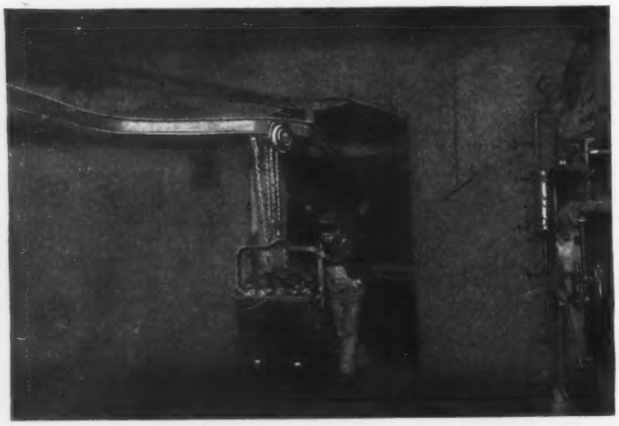


Fig. 2—Bucket Suspended from Carriage on Overhead Track.

located in relation to the boiler-room as the general conditions will permit. There are 21,000 hp of boilers equipped with automatic stokers, and the coal-handling problem is, therefore, reduced to the simplest basis. Yet the transfer of the coal from the bunkers to the hoppers of the stokers presents some problems of interest to every engineer. The coal is handled in iron buckets holding about 600 lb. These buckets are attached to and hung on the hook of a Yale & Towne electric hoist, which in its turn is built into a trolley running on an overhead track leading from the bunkers to the hoppers of the various stokers. In operation the buckets are lowered to a point opposite the mouth of the bunker chute to permit the coal to flow into them by gravity from the bunkers. A pull on the switch then starts the electric hoists and the bucket is soon lifted high enough to enable it to start on its journey to the hoppers of the stokers.

This journey, accomplished by means of a smaller motor which is geared to and drives the trolley wheels, is made in a few seconds, and the coal is then discharged by dumping into the hoppers of the stokers. A simple switch in the overhead track enables the hoist to be run to a point where it can pick up the ash cans, and these are all handled as swiftly and cheaply as is the coal.

The installation at the Fifth Avenue Building and a number of others of the same character are made by the Yale & Towne Manufacturing Company, New York, N. Y.

AIR-COOLED CHOKE COILS.

It is sometimes convenient to mount choke coils on ceilings so that the insulating-coil supports hang pendent, and at other times it is preferable to arrange them so that the coil rests on the supports. This shows a new Westinghouse coil that can be mounted either way, because the insulating columns can be removed and inverted by taking out four bolts.

An aluminum rod, bent into a helix of about 15-in. diameter

Choke Coil Mounted on Supports.

and containing about thirty turns, forms the coil proper. Bracing clamps are provided to give mechanical strength to the helix. The aluminum rod used is of sufficient diameter safely to carry 200 amp. Each coil is supported on two insulating columns made up of porcelain insulators, which, except for the end pieces, are interchangeable.

This type of coil can be mounted in any position convenient for the wiring, on the floor, wall or ceiling. For floor mounting the parts are arranged as shown in Fig. 1 and for inverted mounting the insulator columns are inverted and the base attached to the ceiling. The insulating columns are supported on substantial cast-iron blocks fixed on wooden bases. These choke coils are intended principally for the protection of transformers and should not be used for generators. Where greater reactance than is afforded by a single coil is desired for the higher voltage circuits two or more coils may be connected in series.

WIRE GRIP WITH LOCKING FEATURE.

The Western Electric Company has recently placed on the market a "Buffalo grip" with a special locking feature. In

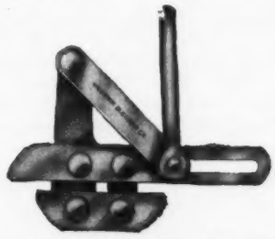


Fig. 1—Grip with Jaw Held Open.

Fig. 1 the grip is shown with the jaw held open by the locking device. A turn of the handle locks the jaw in any position and enables the lineman to insert the wire in the grip easily and

Fig. 2—Grip Closed.

quickly. When the handle is pushed down, as shown in Fig. 2, the wire is held in a tight grip. The grip is made in various sizes for both bare and insulated wire, and can be supplied both with and without pulleys.

Convention Echoes

As is well known, there were no official exhibits connected with the convention just closed, Class D associate members having voted to forego the usual collective display this year. Several manufacturing companies, however, rented quarters in the immediate vicinity of the Engineering Societies Building where exhibitions of their wares were made during the week. Among these were the General Electric Company, the Weston Electrical Instrument Company, the Holophane Company and Gudeman & Company. Other companies, such as the Westinghouse Electric & Manufacturing Company, the Wagner Electric Manufacturing Company, etc., maintained headquarters in many of the hotels near by. There was, however, a host of other manufacturers or their agents in evidence during the week, the following brief references by no means covering the whole or giving any indication of their number.

H. H. Cudmore was ably assisted by W. C. Wing in keeping Brilliant lamps well to the front.

The Pittsburgh Transformer Company was represented by Mr. R. V. Bingay and Mr. H. G. Steel.

Mr. A. S. King, New York representative of the Sterling Varnish Company, represented that company.

George Hearn, of the Ricker Manufacturing Company, Rochester, was on hand as usual and followed the various sessions closely.

The Speer Carbon Company, of St. Marys, Pa., was represented as usual by Mr. John S. Speer, who was accompanied by Mrs. Speer and the two little Speers.

W. K. Archbold, of the Archbold-Brady Company, Syracuse, was very much in evidence among the manufacturers and engineers who attended the convention.

Mr. L. P. Sawyer, of the Buckeye Electric Company, Cleveland, was accompanied by Mrs. Sawyer, and as usual was the genial host at a number of pleasant little informal gatherings.

N. L. Norris and "Banner Betterness" are synonymous. It is hardly necessary to record the fact that their home is in Youngstown, Ohio, and that both have been in New York this week.

The Electric Storage Battery Company, of Philadelphia, was represented by Mr. Herbert Lloyd, president, and Mr. Charles Blizard, vice-president and general sales manager. Mr. Blizard was accompanied by Mrs. Blizard.

The Tungstolier Company.—No convention is complete without Mr. E. J. Kulas, of the Tungstolier Company. Mr. Kulas still hails from Cleveland, though his general offices have been moved to the plant at Conneaut, Ohio.

Wm. Coale, of the Sterling Electrical Manufacturing Company, has been willing to tell you at any time all about the complete Mazda unit street-lighting system which Warren, Ohio, is going to turn on for the first time next week.

Mr. C. L. Bundy, of the Philadelphia Electrical Manufacturing Company, represented his line at the convention. Mr. Bundy has been quite sick for some time past. His many friends are glad to see him looking so well and quite like himself again.

Triumph Electric Company.—One of the well-known visitors at convention headquarters was Mr. W. H. Jacob, the genial representative of the Triumph Electric Company, Cincinnati, who was warmly greeted by his many friends in the electrical fraternity.

The National Carbon Company, Cleveland, was ably represented by Mr. J. F. Kerlin and Mr. C. W. Wilkins. In addition to its personal representatives catalogs and literature describing the various products of the company were on file in the catalog exhibit.

Mr. Harry Curtis Rice, of the General Incandescent Lamp Company, Cleveland, was present and everybody is glad that he brought Mrs. Rice to the convention. This is the first opportunity which many have had to offer personal congratulations on their wedding, which occurred in February.

Mr. C. L. Eshleman, sales manager of the Adams-Bagnall Electric Company, Cleveland, was in attendance all the week and was particularly enthusiastic about "Abolites," which are the most recent addition to the A-B line and are being put onto the market in both commercial and industrial types.

H. W. Johns-Manville Company, New York, was represented by the following staff: Messrs. J. W. Perry, New York; G. A. Saylor, Milwaukee; H. M. Frantz, Chicago; W. E. Rapp, St. Louis; Daniel Fitts, Boston; E. C. Cameron, Boston; S. G. Meek, New York; J. R. McLain, New York; H. M. Slauson, New York; A. D. Miles, New York; E. B. Hatch, president Johns-Pratt Company; R. C. Cole, the Johns-Pratt Company.

Live Lamp Delegation.—Strongly in evidence among the wearers of the dark-brown badges were the delegates from the National Electric Lamp Association, and from its member companies in various cities. The following gentlemen were from the association's headquarters and engineering department in Cleveland, Ohio: Mr. F. S. Terry, Mr. B. G. Tremaine, Mr. H. A. Tremaine, Mr. J. Robert Crouse, Mr. H. M. Vanswoll, Mr. E. S. Doane, Mr. Philip S. Dodd, Dr. Edward P. Hyde, Mr. Glenn G. Webster, Mr. W. M. Skiff, Mr. G. S. Merrill, Mr. Paul F. Bauder, Mr. N. H. Boynton, Mr. Roscoe Scott, Mr. Ralph Beman, Mr. R. E. Campbell, Mr. M. D. Cooper, Mr. Hugo E. Eisenmenger, Mr. Ward Harrison and Mr. J. G. Henninger. Among the officials and representatives of individual member companies of the National Electric Lamp Association who registered at the convention were the following: Mr. M. L. Norris, the Banner Electric Company; Messrs. E. H. Haughton and G. G. Lockwood, the Bryan-Marsh Company; Messrs. H. H. Cudmore and W. C. Wing, the Brilliant Electric Company; Mr. L. P. Sawyer, the Buckeye Electric Company; Messrs. C. Leonard and J. S. Lehman, the Columbia Incandescent Lamp Company; Mr. L. Lobenthal, the Economical Electric Lamp Company; Mr. H. C. Rice, the General Incandescent Lamp Company; Mr. C. R. Tock, the Munder Electric Company; Mr. William Coate, the Sterling Electrical Manufacturing Company, and Mr. C. O. Brandel, the Warren Electric & Specialty Company.

Industrial and Commercial News

The Week in Trade.

OPTIMISM for the future is evidenced in many sections of the country, and while the increase in new business each week is small, with the totals well under those for this period in recent years, a gradual improvement is being made in general business in volume as well as in tone. There is not, on the other hand, the marked increase which many hoped would follow the Standard Oil decision. The Supreme Court handed down its decision on Monday in the case of the American Tobacco Company, holding that the corporation is a combination in restraint of trade in violation of the Sherman anti-trust law, and ordering the dissolution of the combine. In spite of announcement of both of these rulings, there naturally remains some hesitancy to become involved to a serious extent before prices become more settled, both as to levels and time, for with the present tendency to shade, as shown during the week, when the Republic Iron & Steel Company, in accordance with a more aggressive sales policy, lowered its price on bars, followed by similar action by other steel companies, there arises a doubt as to the wisdom of commitment at such a time. Increase in business for the week has been most marked in retail trade, as was natural with the continuation of warm weather. This, to some extent, has benefited jobbing and wholesale lines, but buying remains on a narrow scale, and apparently for current uses. Demand for cotton goods has increased and a fair business has been done in dry goods. The reduction in steel prices is one of the most important features of the week, and the results in the iron and steel trades will be reflected to a considerable extent upon trade as a whole. Collections continue to be reported slow to fair. Business failures for the week ended May 25, as reported by *Bradstreet's*, were 236, as compared with 235 for last week, 200 for the same week in 1910, 205 in 1909, 263 in 1908 and 142 in 1907.

The Copper Market.

SALES to domestic interests have been in the small volume of those of the previous week, but export business is reported slightly improved. The tone of the market throughout the week has been rather firm and prices in this country are practically unchanged. In London slight gains were registered. Rumors of the likelihood of a consolidation between the large producing interests continue in abundance, but none is well sustained and nothing definite is offered at this time. Greater stability as regards prices would tend to encourage sales, inasmuch as buyers at present show no desire to commit themselves to a large extent, having no certainty that prices are well settled or have reached the bottom. There is every reason to believe that merging of the great producing interests will be effected ultimately, but the present situation is not benefited by this probability and will undoubtedly be little bettered until drastic changes are made in the present system of operation as regards output. Each week shows the existence of hand-to-mouth proceedings in the copper trade, and the sooner curtailment is made in output in keeping with the demand the sooner improvement may be expected. The widespread rumors of merging were, to some extent, at the bottom of the foreign purchases, and contracts placed for electrolytic were made at advanced prices. This movement was reflected in the domestic market in higher prices asked by producers of electrolytic. There was little response from domestic consumers and sales continued in small volume throughout the week. Exports for the month, including May 29, were 23,926 tons. The daily call on the Metal Exchange May 29 quoted copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	11.70	12.00	....
May	11.70	12.00	11.85
June	11.70	12.00	11.85
July	11.70	12.00	11.85
August	11.70	12.00	11.85

The London market, May 29, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	55 0 0	55 0 0
Standard copper, futures	55 11 3	55 12 6

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	12.30c	11.57½c
London, spot	£56 15 0	£53 7 6
London, futures	57 12 6	54 0 0
Best selected	60 5 0	57 5 0

Industrial and Commercial Notes.

Westinghouse Railway Orders.—The Westinghouse Electric & Manufacturing Company has received orders from the Philadelphia & Easton Electric Railway Company, of Doylestown, Pa., for two quadruple equipments of No. 101 B2 motors, with type K 28 control; from the Asheville & East Tennessee Railway Company, Asheville, N. C., for a quadruple equipment of No. 307 motors, with type K 35-G control, and from the Wausau Street Railroad Company, of Wausau, Wis., for a quadruple equipment of No. 307 motors, with type K 35 control. The Toledo Railway & Light Company has ordered 100 box-frame, interpole street-railway motors; New York, New Haven & Hartford Railroad, four quadruple equipments of alternating-current railway motors with unit-switch control; Guelph Radial Railway Company, of Ontario, one 27-ton locomotive, having four railway motors, with control. Recent street-railway motor business includes orders from the Hummelstown & Campbellstown Street Railway, Hershey, Pa.; Nashville Railway & Light Company, of Nashville, Tenn.; Cumberland Electric Railway Company, Cumberland, Md.; Frederick Railway Company, Frederick, Md., and Connecticut Company, of New Haven, Conn. Among foreign business lately secured was an order from the Takasaki Water Power Electric Company, of Japan, for two double equipments of street-railway motors with controllers. The order was placed through Takata & Company, the Westinghouse Company's representatives in Japan.

Sprague Electric Company Becomes Sprague Electric Works.—On June 1, 1911, the Sprague Electric Company will be merged with the General Electric Company, of Schenectady, N. Y. Its business will be conducted under the name Sprague Electric Works of General Electric Company. The manufacture and sale of the lines of apparatus and supplies heretofore exploited by the Sprague Electric Company will be continued by the Sprague Electric Works of General Electric Company under the same organization, with D. C. Durland in responsible charge as general manager. All correspondence will be with the Sprague Electric Works at the same address as in the past. Bills and statements will be rendered from, and remittances made to, the Sprague Electric Works, 527 West Thirty-fourth Street, New York, N. Y. The offices of the Sprague Electric Works will be continued as heretofore, with main offices at 527-531 West Thirty-fourth Street, New York, N. Y., and branch offices in principal cities.

H. M. Byllesby in New Company.—The Appalachian Power Company, of Richmond, with an authorized capital of $25,000,000, has been chartered. The new company is promoted by New York and Chicago interests and will operate in southwestern Virginia, with rights to enter any city. This will touch the Pocahontas coal fields and include the towns of Bramwell, Graham, Bluefield, Pocahontas and Princeton. The officers of the company are: H. M. Byllesby, president; C. M. Wells, New York, vice-president; Elmer Dover, Chicago, secretary, and R. J. Graff, Chicago, treasurer. Messrs. Viele, Blackwell and Buck, of New York, who are back of the New River developments, are interested in the proposition.

Cutler-Hammer Company.—Announcement is made by the Cutler-Hammer Company of the establishment of a new department to be devoted exclusively to the design and manufacture of electrical appliances for industrial heating. The thoroughly equipped New York factory of the company, 144th Street and Southern Boulevard, will be devoted principally to the manufacture of this class of apparatus, under the direction and supervision of W. S. Hadaway, Jr., the well-known electric-heating engineer.

General Electric Sales.—An order from the Pacific Electric Railway Company, of Los Angeles, includes the following equipment: Four motor-generator sets, each consisting of an 1120-kw, 2200-volt, three-phase synchronous motor directly connected to a 100-kw, 600-volt direct-current generator, for operation at 500 r.p.m.; three motor-generator sets, each consisting of one 900-hp, 2200-volt, three-phase induction motor directly connected to a 600-kw, 600-volt direct-current generator for operation at 750 r.p.m.; fifty quadruple, 500-volt railway equipments and controllers; nine 450 transformers and nine 300-kw transformers, all of which are designed for 15,000 volts primary and 2250 volts secondary. The Omaha & Council Bluffs Street Railway Company, Omaha, Neb., has ordered the following apparatus from the General Electric Company: Three 1000-kw, 600-volt rotary converters; two 1050-kw, three-phase transformers; three 350-kw, single-phase transformers; one 75-kw turbo-driven exciter; one blower set, one air compressor, one switchboard, twenty double-motor GE-80 car equipments, five double-motor GE-20 one-car equipments, five straight air-brake equipments with CP-27 compressors. Two of the 1000 kw rotary-converter equipments will be installed in the new South Omaha substation, while the third is for installation in the power station. The car equipments are for new cars, which will be supplied by the American Car Company. The Wilmington & Philadelphia Traction Company has purchased from the General Electric Company a 4000-kw turbo-generator, a 100-kw turbo-exciter and two 1000-kw, 250-volt motor-generator sets, which will be used on the three-wire lighting system. The General Electric Company has also sold one 300-kw, 2300-600-volt rotary converter to the Tri-State Electric Railway Company, at Wellsburg, W. Va. This and the foregoing apparatus were sold through J. G. White & Company. The Mercer County Traction Company, of Trenton, N. J., has purchased ten double railway equipments from the General Electric Company.

Important Movement to Forward American Export Trade.—Through the co-operation of a number of large manufacturers and with the support of one of the largest financial institutions in the country, the Allied Machinery Company of America has been organized for the purpose of systematically forwarding American export trade. To this end there will be established in each foreign country where there is a prospect of increasing the demand for American manufactures a bureau in charge of a specialist in the line of promotion work to be carried on. An important feature of the plan is to provide for extending to purchasers time credits such as they are accustomed to receive in their own country, or from other than American exporters. One of the greatest handicaps to American export trade has been the refusal or inability of our manufacturers to extend the credits customary in foreign countries. Captain Godfrey L. Carden, who is well known in manufacturing circles in this country and abroad for his investigations as agent of the Bureau of Commerce of export conditions in Europe, is one of the vice-presidents of the organization, and sailed this week for Europe to commence the establishment there of bureaus in the several important countries.

Electric Storage Battery Company.—A contract for the battery equipment of the thirty-five new storage-battery cars for the Dry Dock, East Broadway & Battery Railroad Company, of New York City, which are to be placed in service on its lines during the early summer, has been awarded to the Electric Storage Battery Company, of Philadelphia. These new cars have been specially designed by the Third Avenue Railroad Company to give the necessary strength with minimum weight. Each car is equipped with two motors and the batteries are installed under the longitudinal seats. The cars will give a maximum speed of 15 miles per hour on level track with a scheduled speed of 7 to 8 miles an hour including stops. They are of the open-platform single-truck type, with 18-ft. car bodies. The battery equipment of each car consists of fifty-eight oxide cells. Cells of this type have been operated in street-car service in New York for about a year with marked success.

Copper Wire for Boise Project.—At 2 p. m. May 17 bids were opened at the Department of the Interior, United States Reclamation Service, Los Angeles, Cal., on the following lines for the Boise Project, Idaho: (1) 43,000 lb. No. 3 B. & S. 7-wire, hard-drawn copper strand; (2) 500 lb. No. 6 B. & S. soft copper wire; (3) 38,000 lb. No. 3 B. & S. 7-wire, hard-drawn copper strand; (4) 350 lb. No. 6 B. & S. soft copper wire. Three bids were received as follows: Standard Underground Cable Company, San Francisco, Cal.—(1) 0.1425 cent per pound; (2) 0.14 cent per pound. American Steel & Wire Company, Los Angeles, Cal.—(1) 0.1475 cent per pound; (2) 0.1425 cent per pound. John A. Roebling's Sons Company, Trenton, N. J.—(1) 0.1475 cent per pound; (2) 0.1425 cent per pound; (3) 0.1475 cent per pound; (4) 0.1425 cent per pound.

Appeal Granted in Telephone Suit.—Judge Colt, of the United States Circuit Court, has allowed an appeal to the United States Circuit Court of Appeals in the suit of the Western Union Telegraph Company against the American Bell Telephone Company. The Circuit Court last April, after ten years of litigation based on patent rights, awarded $3,141,529 to the Western Union Telegraph Company. Certain shares of stock in subsidiary companies of the American Bell Telephone Company were also awarded to the Western Union Company, based upon agreement between the parties. The American Bell Telephone Company has filed a bond of $7,500,000 with the court to secure the appeal. The American Telephone & Telegraph Company is given as security.

Large Canadian Developments.—It is reported that the Diamond Mills Company and the Dominion Securities Company have purchased a large tract near Revelstoke, B. C., on which they plan the construction of a large water-power and paper pulp plant. The total first cost is estimated as close to $20,000,000. Work is to be pushed, with a view of completing the water-power plant by next year, and the total construction within three years. Plans include the building of a trolley line and 50 miles of railroad for connecting the mills with the town. Charles A. Barnum, of Chicago; F. C. Adams, of Duluth, and Charles E. Stone, of St. Paul, are mentioned as being interested in the project.

Porcelain Companies Merged.—The General Porcelain Company, which was recently incorporated in New Jersey, has taken over the Ohio Porcelain Company, the George F. Brunt Porcelain Company, the Anderson Porcelain Company and the Electric Company, all of East Liverpool, Ohio. It is considered likely that the United States Porcelain Company, of New Cumberland, W. Va., and Findlay, Ohio, and three pottery concerns in New Jersey will enter into the combination. J. N. Parker, of Boston, one of the largest dealers in porcelain for electrical uses, is mentioned as the probable president of the new combination.

Canadian Power Company Enlarges.—Report of the purchase of the Central Heat, Light & Power Company, of Montreal, by the Canadian Light & Power Company is confirmed by E. A. Roberts, vice-president of the latter company. This acquisition will afford a means for the Canadian Light & Power Company to distribute energy in the central section of Montreal. The price paid for the Central company is said to be in the neighborhood of $500,000.

Ends Investigation of New York Commission.—John N. Carlisle, who was appointed by Governor Dix to look into the affairs of the Public Service Commission for the First District of New York, has presented his report to the Governor. Mr. Carlisle states, in part, that any change at this time in the personnel of the commission would mean further delay in settling the subway question, and is considered unwise for this reason.

Street Lighting in Winnipeg.—The city of Winnipeg, Manitoba, proposes that its two main streets, which are 132 feet wide and 96 feet from curb to curb, shall be the most effectively and efficiently lighted thoroughfares in the world. A study is now being made of street-lighting systems prior to deciding on details. Mr. J. G. Rossman, manager of the Hydroelectric Power Department of the city, has charge of the matter.

Soreng & Beedle.—The firm of Soreng & Beedle, recently organized in Danville, Ky., for carrying on a general consulting engineering business, will specialize in the promotion and construction of small and medium-sized electric-lighting plants for rural communities. They desire to receive catalogs and price and discount lists from manufacturers and jobbers.

General Vehicle Company Buys Land.—Fifty lots near Long Island City have been purchased by the General Vehicle Company, the price being in the neighborhood of $100,000. It is believed that the site will be used for the erection of a branch plant.

Prize for Safety Lamp.—A report from London states that a coal-mine owner has offered, through Winston Churchill, the Home Secretary, a prize of $5,000 for an efficient electric safety lamp.

Financial.

The Week in Wall Street.

At the close of the week few signs remained of the boom which revived the Stock Exchange immediately after the Standard Oil decision. The volume of transactions has steadily decreased, and totals for the week reach only 2,530,758, as compared with 3,653,630 for the week preceding. Prices have not suffered materially, despite the irregularity of the week, and the majority of advances reached in the recent flurry are maintained. The bond market has been active since last report, and total sales of some $140,000,000 of securities are registered by local financial interests. This is regarded as an outcome of the decision and held to be part of the funds reported some time ago as being reserved for conservative investment pending the results of the Standard Oil case. Among the larger transactions of interest during the week were the financing of the Chicago elevated merger and the taking of several of the long-term issues of several of the railroads. The price cutting in the steel trade was followed by slight reaction in the stock market, and the dullness continued throughout the rest of the week and through Monday, pending the American Tobacco decision. Naturally, less interest was shown early in the week in the possibility of receiving the American Tobacco decision than in the case of the first ruling, and the transactions of the market were not greatly influenced by the prospect of its anouncement before the recess. The stock market will respond more readily than will general trade to slight improvements throughout the country, and although the volume of business registered for the year is small as yet, and the summer season is not likely, at best, to encourage briskness, it is felt that the end of the year will see much better results than have been made to date. The crops are still to be heard from, and with the satisfactory yield now predicted and further readjustment possible now that the decisions are known, confidence should be restored and rapid progress made. Money markets are still on an easy basis. Rates May 29 were: Call, 2@2¼ per cent; ninety days, 2½@3 per cent. The quotations in the tables are those of the close of May 29.

NEW YORK.

	May 22.	May 29.	Shares Sold.		May 22.	May 29.	Shares Sold.
All. Ch.....	8¼	9¼	500	Int. Met, pf.	53	52⅛	5,100
All. Ch., pf..	31	33	1,400	Mackay Cos..	92¾*	90*	700
Amal. Cop...	67⅛	67¾	72,420	Mackay C.,pf.	76½	76¼*	200
Am. D. T....	20½*	20½*	———	Man. Elev...	137¾	136⅝	100
Am. Loco....	43	41¼*	3,600	Met. St. Ry..	15*	15*	...
Am. Loco., pf.	108	108¼*	700	N.Y.&N.J.Tel.	139½*	139½*	...
Am. Tel. & C.	82½*	82*	67	Steel, com....	80⅝	78⅛	672,244
Am. T. & T..	148⅞	148¾	9,000	Steel, pfd....	120¼	118⅝	5,220
B. R. T.....	80⅝	80	18,735	W. U. T.....	79¼	82⅛	81,648
Gen. Elec...	160½	167½	16,000	West'h, com..	74	78½	29,600
Int. Met....	18¾	18⅞*	5,300	West'h, pfd..	117	118	300

PHILADELPHIA.

	May 22.	May 29.		May 22.	May 29.
Am. Rys.....	44	44½	Phila. Elec.....	16⅞	16⅜
El. Co. of A.....	12*	12*	Phila. R. T.....	18⅛	17¾
Elec. St. B'ty.....	54	54	Phila. Trac.....	83½*	82½*
Elec. St. B'ty., pfd..	30*	30*	Union Trac.....	46½	46¼

CHICAGO.

	May 22.	May 29.		May 22.	May 29.
Chi. City Ry.....	186*	186*	Chi. Tel Co.....	123	123
Chi. Rs., Ser. 1.....	80*	80*	Met. El. Co.....	24¾	26*
Chi. Rs., Ser. 2.....	21*	22½*	Met. El., pfd.....	71	72¾*
Com. Edison.....	128½	129⅛	Nat'l Car.....	120*	120*
Chi. Subways.....	4¾*	4⅛*	Nat'l Car, pfd.....	120*	120*

BOSTON.

	May 22.	May 29.		May 22.	May 29.
Am. T. & T.....	149	148⅞	Mex. Tel.....	4*	4*
Cum. Tel.....	153¼*	157½	Mex. Tel., pfd.....	6½	6½*
Edison E., Ill.....	287	286¾	N. E. Tel.....	146	146*
Gen. Elec.....	161¼	167¾	W. T. & T.....	19	19⅜
Mass. E. Ry.....	20	21¼	W. T. & T., pfd....	96	96
Mass. E. Ry., pf....	89½	89½			

*Last price quoted.
Shares sold for week May 22 to May 29.

Financial Notes.

Montreal Light, Heat & Power Company.—The report of the Montreal Light, Heat & Power Company for the year ended April 30, 1911, compares favorably with that for the year preceding. Gross earnings increased $163,180, amounting to $4,404,126, and operating expenses and maintenance decreased $21,092, amounting to $1,827,786, leaving net earnings of $2,576,340, which represents an increase for the year of $184,272. Deducting fixed charges of $472,051, which were $8,816 under last year's figures, left a balance of $2,104,289 available for dividends, this being $193,088 in excess of the balance of the previous year. Dividends amounted to $1,275,000, and, after $476,011 was deducted for depreciation, renewals, etc., from the $829,289 remaining, there was left a surplus for the year of $353,278. This was $32,077 more than the previous surplus and made a total profit and loss surplus of $2,395,839. In addition to the allowance for depreciation and renewals included above, $373,528 was also charged to the same item. H. S. Holt, president of the company, states that the policy of the company is to provide against all possible contingencies and that the depreciation item, in accordance with this, is naturally large in keeping with the rapid growth of the company's business. The report states that during the year there were redeemed for cancellation, in accordance with the mortgages securing the respective issues, $70,000 of the mortgage debt of the company; that various additions at the gas and hydraulic plant of the company at Lachine Rapids have been completed and are in operation; that extensions to the underground conduit system are being considered, together with appropriations for extending both gas and electric distributing systems to meet the rapid growth of business. As a result of the reduction in gas and electric rates, May 1, 1910, customers' discounts during the year amounted to $559,944, against $332,598 for the previous year.

Chicago Telephone to Issue More Bonds.—About $5,000,000 additional first mortgage 5 per cent bonds will be issued next fall by the Chicago Telephone Company. This will be the first financing by the company since the marketing of the present outstanding $5,000,000 bonds, in 1909. The mortgage permits the issuing of $50,000,000 at a rate not exceeding $5,000,000 annually, and not exceeding 50 per cent of the total assets. In connection with the financing, President Sunny is quoted as follows: "Chicago Telephone bonds to be issued are for new construction in Chicago and the ten counties covered by our operations. The extension is not extraordinary, but in line with our regular growth of 38,000 telephones, which will equal this year's record. Gross revenues show steady growth, but larger payrolls and other operating expenses absorb full proportion, leaving the net about the same as last year." Work is to be started immediately on the new sixteen-story building for the Chicago Telephone Company, which is to cost about $1,500,000.

Columbus Railway Company Stock.—A special meeting of the stockholders of the Columbus Railway Company will be held June 26 to authorize a $3,000,000 increase in capital. This is to be issued to reimburse the Columbus Railway & Light Company for financing improvements upon the system of the Columbus Railway Company. The additional capital will be divided equally into preferred and common stock, which will make the total authorized common stock amount to $5,000,000 and the preferred to $4,500,000. The terms of the lease to the Columbus Railway & Light Company provide that the latter shall be reimbursed for permanent betterments or equipment either in cash or in securities of the Columbus Railway Company at par. There is a balance of some $113,000 now due the leasing company, the Columbus Railway & Light Company having received about $1,483,000 to date in cash and stock, in accordance with the agreement.

Niagara Falls Power Company.—The combined statement of the Niagara Falls Power Company and the Canadian Niagara Power Company for the quarter ended March 31, 1911, gives a total operating revenue of $544,171; expenses and taxes, $158,023; net operating revenue, $386,149, to which is added other income of $16,891, making a total income of $403,040. Charges are given as $272,057, leaving a surplus of $130,982. The additional capital stock of the Niagara Falls Power Company, recently listed on the New York Stock Exchange, amounting to $1,560,200, will be used to retire at par all of the Canadian collateral debentures of the company, now outstanding, and to acquire, share for share, 491 shares of the Tonawanda Power Company, not yet held by the Niagara Falls Company, as outlined in the *Electrical World*, April 27 The total amount of Niagara Falls Power Company stock now listed is given as $5,757,000.

United Railways & Electric Bond Payments.—The board of directors of the United Railways & Electric Company, of Baltimore, has approved the ruling of the executive committee to pay the United Railway's income bonds in cash June 1. Payment of all outstanding dividends on the preferred stock of the company will also be made at this time.

Washington, Baltimore & Annapolis Earnings.—The report of earnings of the Washington, Baltimore & Annapolis Electric Railway Company for the month of March shows a decrease in both gross and net revenues, as compared with the corresponding period of 1910. The gross income of the property for the month was $48,048, as against $54,426 for last year, making a decrease of $6,377 for March of this year. Operating expenses were $30,055, as compared with $27,981 for the same month of the preceding year, or a gain of $2,074 for the current year. The net revenues of the property were $17,993, as against $26,244 for 1910, the loss for March, 1911, being $8,251. The business of the company for March was not as bad as it might first appear, in view of the fact that March of 1910 was one of the best months in the history of the road. The Legislature was in session and travel between Baltimore and Annapolis was heavy. As a result of this heavy passenger traffic, the income for March, 1910, showed a large gain over that for the same month of 1909. For the nine months of the fiscal year ended March 30 the Washington, Baltimore & Annapolis made an excellent record, both gross and net income showing a satisfactory increase over the corresponding period of the preceding fiscal year. Gross income for the nine months totaled $499,685, as against $450,067 for 1910, the gain for 1911 being $49,618, while operating expenses were $262,410, as compared with $275,977, showing a decrease of $13,567. The net income for the period mentioned was $237,274, as compared with $183,089 for last year, making a gain of $54,185 for the nine months of the present fiscal year.

Kansas City Railway & Light Dividend.—The passing of the preferred dividend of the Kansas City Railway & Light Company, which is payable June 1, as mentioned in the issue of May 25, is the first since 1903. The common stock has never paid a dividend. The quarterly dividend of 1¼ per cent on the $9,500,000 preferred stock amounts to $119,000. R. J. Dunham, chairman of the board, has made the following comment: "It is thought that the ultimate interests of the stockholders will be best subserved by this course for these reasons: The company's $5,500,000 6 per cent notes mature Sept. 1, 1912, when some arrangement must be made to meet or refund them. Meanwhile, it is impossible to obtain new money for extensions and additions without giving security upon the new property acquired therewith. This security can only be given with the consent of the city, which apparently cannot be obtained. All resources must at the present time be conserved so that the present franchise requirements may, as far as possible, be met from the earnings without any increase of the floating indebtedness. The Kansas City bankers will not increase that indebtedness but insist upon its reduction. The interests of stockholders are, of course, subordinate to the demands of creditors and rights of the public." Gross earnings for the year ended May 31, 1911, were in excess of $7,000,000, as compared with $6,633,620 for the preceding year.

United Railways of St. Louis Bonds.—Anouncement is made that arrangements have been completed by the United Railways of St. Louis for the refunding of the $1,500,000 5 per cent underlying bonds of the Lindell Railway Company. These mature Aug. 1, 1911, and will be replaced by an equal amount of 4½ per cent ten-year securities, sale of which has been made. The controlling interest in the traction companies of St. Louis is held by the North American Company, which owns some 75 per cent of the $24,913,800 common stock. Another suit has been filed by the city of St. Louis toward collection of the passenger tax, over which litigation has been held for some time. The city now asks $1,923,617 on this basis. The point is made by the United Railways of St. Louis that the tax is unconstitutional, being excessive and a double taxation, the contention of the city being that the tax is justifiable on the grounds that it is a license tax and cannot be classed as a property tax.

Independence Electric Company Changes Ownership.—The Kansas Gas & Electric Company has acquired the properties and franchises of the Independence Electric Company, of Independence, Kan. The company has franchises extending to 1926, and its properties are free from bonded indebtedness. The Kansas Gas & Electric Company, which was incorporated 1909 to acquire by consolidation the United Gas Company, the Edison Light & Power Company, the Gas & Electrical Appliance Company, of Wichita, Kan., and the Home Light, Heat & Power Company, of Pittsburgh and Frontenac, Kan., is controlled by the American Power & Light Company, which is controlled in turn by the Electric Bond & Share Company and affiliated interests.

Long Acre Electric Light & Power Company.—A development arose this week in the case of the Long Acre Electric Light & Power Company, which has been endeavoring for some time to obtain permission from the Public Service Commission for the First District, New York, to float a large stock issue and mortgage, as mentioned in these columns during the year. Announcement was made that the commission would act upon the application of the company by proceeding to consider the amount of stocks and bonds which the company should be allowed to issue and the terms under which these securities might be approved. Hearings will be given shortly upon this point.

Federal Telephone & Telegraph Company.—The Public Service Commission for the Second District of New York, has authorized the Federal Telephone & Telegraph Company to issue $578,000 5 per cent bonds, on security of its mortgage of March 24, 1909. The proceeds are to be utilized for acquiring the securities of the Niagara Home Telephone Company, the Dunkirk Home Telephone Company and the Independent Union Telegraph Company.

Georgia Power Company Bonds.—The Georgia Power Company has received permission from the Georgia Railroad Commission to issue $20,000,000 stocks and bonds. Description of the plants now in course of construction by the company has been given from time to time in the *Electrical World*.

DIVIDENDS.

American Telegraph & Cable Company, quarterly, 1¾ per cent, payable July 1.

Chicago City Railway Company, quarterly, 2½ per cent, payable June 30.

Mackay Companies, quarterly, common, 1 per cent; preferred, 1¾ per cent; payable July 1.

Westinghouse Electric & Manufacturing Company, quarterly, preferred, 1¾ per cent, payable July 15.

Winnipeg Electric Company, quarterly, $3 per share, payable July 1.

REPORTS OF EARNINGS.

ELECTRICAL PROPERTIES COMPANY.

Period.		Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
Yr., Apr.,	1911	$251,841	$62,101	$189,740	.....	.....
" "	1910	239,053	54,062	184,991	.....	.....

INTERBOROUGH RAPID TRANSIT COMPANY.

April,	1911	$2,658,586	$1,071,177	$1,446,408	$888,030	$558,377
"	1910	2,564,775	937,047	1,500,755	878,356	622,399

MONTREAL LIGHT, HEAT & POWER COMPANY.

Yr., Apr.,	1911	$4,404,126	$1,827,786	$2,576,340	$472,051	$2,104,289
" "	1910	4,240,945	1,848,878	2,392,067	480,866	1,911,200

MONTREAL STREET RAILWAY.

April,	1911	$372,309	$200,718	$171,591	$50,337	$121,254
"	1910	344,766	190,842	153,924	44,584	109,340

NASHVILLE RAILWAY & LIGHT COMPANY.

April	1911	$161,228	$94,554	$66,674	$38,262	$28,412
"	1910	147,519	87,993	59,526	38,092	21,434

PHILADELPHIA COMPANY.

April	1911	$1,817,713	$983,791	$833,922	.....	.....
"	1910	1,699,996	892,692	807,304	.....	.....

PORTLAND RAILWAY, LIGHT & POWER COMPANY.

Year,	1910	$6,064,795	$2,870,077	$3,194,717	$1,678,228	$1,516,489
"	1909	5,190,567	2,569,041	2,621,526	1,493,039	1,128,487

SAO PAULO TRAMWAYS, LIGHT & POWER COMPANY.

April	1911	$284,038	$104,278	$179,760	.....	.....
"	1910	231,521	82,624	148,897	.....	.....

RIO DE JANEIRO TRAMWAYS, LIGHT & POWER COMPANY.

April,	1911	$1,030,111	$511,324	$518,787	.....	.....
"	1910	825,236	427,812	397,424	.....	.....

TWIN CITY RAPID TRANSIT COMPANY.

April,	1911	$620,672	$319,939	$300,732	$140,079	$160,653
"	1910	584,378	268,045	316,332	140,229	176,103

TRI-CITY RAILWAY & LIGHT COMPANY.

April,	1911	$210,755	$124,877	$85,878	$47,186	$38,692
"	1910	190,053	117,754	72,289	43,716	28,582

UNITED TRACTION COMPANY OF ALBANY.

Qtr., Mar.,	1911	$537,234	$364,521	$187,665	$102,860	$84,804
" "	1910	487,144	331,879	173,580	95,863	77,716

UNITED RAILROADS OF SAN FRANCISCO.

April,	1911	$652,866	$363,030	$289,836	.....	.....
"	1910	648,015	366,427	281,588	.....	.....

General News

Construction News.

ONEONTA, ALA.—The installation of an electric-light plant to cost approximately $6,000, in Oneonta, is reported to be under consideration. D. M. Farson & Company, of Chicago, Ill., it is said, are interested in the project.

SYLACAUGA, ALA.—Electricity for operating the municipal electric system is received from the hydroelectric plant located on Hatchett Creek, 16 miles south of the city. The plant, which was recently completed, is equipped with one pair of horizontal twin turbines, developing 375 hp under a 19-ft. head, manufactured by the Trump Manufacturing Company, of Springfield, Ohio.

FAYETTEVILLE, ARK.—The Fayetteville Electric Light & Power Company, it is reported, is contemplating making extensions and improvements to its plant, including the installation of additional machinery, to cost approximately $20,000.

MAMMOTH SPRINGS, ARK.—The Mammoth Springs Electric Light & Power Company, it is reported, is contemplating extending its transmission lines to West Plains, Mo., to supply electricity for lamps and motors in that town.

BAKERSFIELD, CAL.—A new telephone company is being formed by local capitalists. The new company has no connection with the Home Telephone Company. Application will soon be made to the City Trustees and the County Supervisors for franchises to operate in the city and county. J. W. Kelly is interested in the project.

BERKELEY, CAL.—The City Council has fixed the rate for electricity for lamps in Berkeley for the next fiscal year as follows: Arc lamps with moonlight schedule, $4.50 each per month; all-night service, $6 each per month; 16-cp incandescent lamps, all-night service, 50 cents per lamp per month; electroliers, $1.75 each per month; meter rate, 3 cents per kw-hour; for motors, 2½ cents per kw-hour.

FRESNO, CAL.—Arrangements are being made by the San Joaquin Light & Power Company to invade the West Side by the extension of its transmission lines from Madera to Los Banos, Gustine, Dos Palos, Mendota and Firebaugh, work on which will begin about July 1, at which time it is expected that the transmission line now being erected from Copper Mine, near Clovis, to the Bakersfield country will be completed. The company is now extending its transmission lines from Merced to La Grand and Planada on the Santa Fe Railroad, which will supply electricity to the two towns and also to operate pumping plants in the surrounding territory. Another line is to be erected from Corcoran to Angiola, Salida and Stohl, and Corcoran to Buena Vista. Substations are also being erected at the Copper Mine, Caruthers and at Henrietta. A temporary plant is also being installed by the company on the Tule River to supply power for the construction of 3¼ miles of tunnels, of which about 2 miles has been completed. When the lines which are now being erected are completed all the plants of the company will be connected with the main plant at Crane Valley.

LOS ANGELES, CAL.—Plans have been completed by the Los Angeles & San Fernando Electric Railway Company for the construction of an independent electric railway to extend from Los Angeles to San Fernando. The new electric railway will be linked with the new railway now being built by the Los Angeles-Pacific Company to Van Nuys and the road now under construction by the Los Angeles Homes Company to Owensmouth. The officers of the Los Angeles & San Fernando Electric Railway Company are: L. C. Brand, president; W. G. Kerckhoff, vice-president, and J. F. Sartori, secretary and treasurer.

LOS ANGELES, CAL.—A substantial reduction will be made in the prices for electricity in Los Angeles under the schedule fixed by the Board of Utility, which will become effective July 1. Under the new schedule the minimum charge will be reduced from $1 per month to 35 cents per month, but in addition the consumer pays for the amount of electricity used. The price has been reduced from 7 cents to 6½ cents per kw-hour for the first 250 kw used. From 250 kw to 500 kw the rate is 6 cents per kw-hour; from 500 kw to 1000 kw, 5 cents per kw-hour; from 1000 kw to 2000 kw, 4 cents, which is the same as last year, for all used from 2000 kw to 4000 kw, 3 cents per kw-hour, and for all in excess of 4000 kw, 2¾ cents per kw-hour. Under the present schedule the rate is 3 cents per kw-hour for all energy consumed above 2000 kw. Under the new charter the board fixes the rates for motors as well as for lamps. The new rates for motors are as follows: For electricity furnished at less than 15,000 volts; first 100 kw, 7 cents per kw-hour; 100 kw to 500 kw, 6 cents; 500 kw to 1000 kw, 5 cents; 1000 kw to 1500 kw, 4 cents; 1500 kw to 2000 kw, 3 cents; and all above 2000 kw 2 cents. In addition to the charge for the energy used the companies are allowed to charge 50 cents per month for each horse-power furnished, the minimum charge to be $1 per month.

PASADENA, CAL.—The City Council has awarded a contract for the construction of underground conduits along part of Orange Grove Avenue and certain other streets to G. M. Gest for $45,000. Herman Dyer is city clerk.

PASADENA, CAL.—Bids will be received by the Mayor and City Council of Pasadena, at the office of the city clerk, City Hall, Pasadena, Cal., until June 6 for furnishing and installing one turbo-generator set with Terrill regulator and exciter, together with condenser, pumps and auxiliaries with a rating of from 1500 kw to 1650 kw or 1250 kw or 1000 kw. Herman Dyer is city clerk.

SAN FRANCISCO, CAL.—The Northern California Power Company has signed a contract to supply electricity to operate the pumps for irrigating the Carson Colony No. 2, a tract of 1160 acres, situated near Butte City, Glenn County.

SAN FRANCISCO, CAL.—The Board of Supervisors has adopted a resolution authorizing the clerk of the board to advertise for proposals for lighting the streets and outlying districts, and for lighting the public buildings of the city and county for the fiscal year beginning July 1, 1911.

TULARE, CAL.—The Tulare County Power Company has applied to the City Council for a franchise to erect and maintain an electric plant and distributing system in Tulare. C. H. Holly is manager.

WALNUT CREEK, CAL.—The Pacific Gas & Electric Company is reported to be making preparations to extend its transmission lines to Danville to supply electricity for lamps and motors in that town. It is also proposed to supply electrical service to the residents and ranchers along the route of the line.

DANIELSON, CONN.—Arrangements are being made by the Connecticut Mills Company to equip its No. 2 mill for electrical operation and to install additional lamps.

PLAINFIELD, CONN.—Preparations are being made by the Plainfield Mills Corporation for the construction of a new mill, which will be erected near the present mill of the Lawton Company. A new power plant will also be installed. John Porteous is vice-president and general manager.

WASHINGTON, D. C.—Sealed proposals will be received until June 12 for wiring and extension of electric-lighting system in the buildings of Howard University, Washington, D. C., in accordance with plans and specifications, copies of which may be obtained upon application to the chief clerk of the department. Carmi A. Thompson is assistant secretary.

HASTINGS, FLA.—The establishment of an electric-light plant in Hastings is reported to be under consideration.

HAVANA, FLA.—It is reported that a franchise has been granted to a company, recently organized, to install an electric-light plant and ice plant in Havana. James Cheatham and others are said to be interested in the project.

TALLAHASSEE, FLA.—Bids will be received by the city of Tallahassee for $15,000 in bonds, the proceeds to be used for improvements and extensions to the electric and gas plants and water-works system. A. H. Williams is city clerk.

BLACKSHEAR, GA.—The installation of an electric-light plant in Blackshear is reported to be under consideration.

CHICAGO, ILL.—The Chicago Telephone Company, it is said, will issue about $5,000,000 in bonds next fall, the proceeds to be used for new construction in Chicago and the ten counties which its system covers.

CHICAGO, ILL.—Sealed proposals will be received at the office of William Carroll, city electrician, Room 618, City Hall, Chicago, Ill., until June 5, for furnishing the Department of Electricity, city of Chicago, Ill., with 25,000 ft., more or less, of No. 6 B. & S. gage, rubber-covered, lead-incased electric-light cable, in accordance with specifications on file in the office of the city electrician.

FT. WAYNE, IND.—It is reported that surveys are being made of the St. Joseph River under the supervision of Engineer Barnes with a view of locating power sites and building dams.

LAPORTE, IND.—The Laporte Telephone Company has increased its capital stock from $100,000 to $500,000.

NOBLESVILLE, IND.—Harry Sheridan, referee in bankruptcy, has appointed Elmer Wetzell, of Indianapolis, Ind., trustee for the White River Light & Power Company. The trustee was instructed not to make any effort to dispose of the property until the question of turning the property over to the bondholders was decided. The White River Light & Power Company began the construction of a hydroelectric plant on the White River, 2 miles above Noblesville, nearly three years ago. After expending about $50,000 on the plant, work was suspended on account of lack of funds. According to the report of the receiver, the indebtedness of the company exceeds $100,000. The plant has never been operated.

WEBSTER CITY, IA.—Sealed proposals will be received at the office of P. M. Banks, city clerk, Webster City, Ia., for furnishing and installing equipment for the municipal electric-light and power plant as follows: (1) Three 72-in. x 18-ft. return tubular boilers. (2) One 20-in x 36-in.

right-hand, simple non-condensing Corliss engine, 120 r.p.m., 150 lb. working pressure for direct connection to a 300-kva alternator. (3) One 16-in. x 36-in., left-hand, simple non-condensing Corliss engine, 120 r.p.m., 150 lb. working pressure for direct connection to a 200-kva alternator. (4) One No. 77, 500-hp Hoppes Standard feed-water heater with outside float box; all necessary pipe and fittings to connect engines and boilers, boiler feed pumps and heater. (5) One 300-kva, 60-cycle, 2300-volt, 120 r.p.m. alternator with exciter. (6) One 200-kva, 60-cycle, 2300-volt, 120 r.p.m. alternator with exciter, for parallel operation. (7) Switchboard for above apparatus. H. M. Sparboe is Mayor.

HUTCHINSON, KAN.—The United Water, Gas & Electric Company is reported to be negotiating with the towns of Nickerson, Partridge and Arlington with a view of extending its transmission lines to those places to supply electricity for lamps and motors.

INDEPENDENCE, KAN.—The plant and holdings of the Independence Electric Company, of Independence, Kan., have been purchased by the Kansas Gas & Electric Company, which is a subsidiary of the American Power & Light Company.

NICKERSON, KAN.—It is reported that a committee has been appointed to make investigations in connection with the proposition of securing electricity from the plant of the United Water, Gas & Electric Company, of Hutchinson, Kan., to operate a municipal lighting system in Nickerson.

LAFAYETTE, KY.—The Lafayette Ice & Electric Company, which is operating an ice plant in Lafayette, is reported to be installing an electric-light plant. The company is capitalized at $7,500. Samuel Bumpus is general manager.

SHELBYVILLE, KY.—Charles E. Collins, Drexel Building, Philadelphia, Pa., is reported to be preparing plans for the construction of a concrete dam for the Shelbyville Water & Light Company, of Shelbyville, Ky.

LAFAYETTE, LA.—W. L. Eryes, superintendent of the municipal electric-light plant, recommends improvements to the electric-light plant involving an expenditure of about $40,000, including the installation of new machinery and changing the system from direct current to alternating current.

BANGOR, MAINE.—The property of the Bodwell Water Power Company at Milford, Maine, was sold at a foreclosure sale May 19 to Attorney Verrill, who, it is said, represented the bondholders. The price paid for the property was $500,000.

WISCASSET, MAINE.—Arrangements have been made by the Wiscasset Electric Light & Power Company to secure electricity from the plant of the Portland Power & Development Company, located at Damariscotta Mills, 12 miles distant. The Portland company already supplies electrical energy in the villages of Damariscotta, Damariscotta Mills, Noblesville, Newcastle, Boothbay Harbor, East Boothbay, Bayville and the Isle of Springs.

BALTIMORE, MD.—The Public Service Commission has authorized the Consolidated Gas, Electric Light & Power Company to issue bonds to the amount of $844,000, to be sold at not less than 92, the proceeds to be used to take up outstanding obligations and for improvements and extensions to its system. The petition filed by the company states that $82,263 is needed for the Westport electric plant; for the Arlington substation $79,565 is required; extensions will be made to other substations, and $60,000 will be used to refund bonds of the Brush and Edison companies, which have been taken over by the Consolidated company. It is also proposed to pay $262,000 of the floating indebtedness out of the bond issue.

FREDERICK, MD.—The Frederick Railroad Company has applied to the Public Service Commission for authority to issue $156,000 in bonds, the proceeds to be used for improvements and extensions to its system.

GLOUCESTER, MASS.—The Gloucester Electric Company has applied to the State Board of Gas and Electric Light Commissioners for authority to issue capital stock to the amount of $75,000, the proceeds to be used for placing its wires underground, for recent additions to its plant and for extending its transmission lines to the town of Essex.

NORTHAMPTON, MASS.—The City Council has refused to accept the new contract submitted by the Northampton Electric Lighting Company for street lighting for a term of five years. Under the new contract the company offers to supply forty-six arc lamp with all-night service at $86 and $90 each per year; fourteen incandescent lamps with all-night service at $24 and $28 per lamp per year; 63 arc lamps with midnight service at $71.50 and $75.56 each per year; 374 incandescent lamps with midnight service at $18 and $20.51 per lamp per year. Under the terms of the new contract the city would save $1,433 per year.

PITTSFIELD, MASS.—The State Board of Gas and Electric Light Commissioners has granted the Pittsfield Electric Company permission to issue 1500 additional shares of capital stock at $135 per share. The board directs that the proceeds of 1400 shares be applied to the payment of an equal amount of outstanding notes of the company and the remainder for the cancellation of indebtedness incurred for additions to its plant.

WORCESTER, MASS.—The State Board of Gas and Electric Light Commissioners has handed down a decision against Alfred S. Lowell, of Worcester, in his case against the Worcester Electric Light Company. Mr. Lowell, who owns a large department store in Worcester, was granted permission by the Mayor and Aldermen to construct and operate an electric-light plant and to build a conduit across Main Street from his plant to the store. The Worcester Electric Light Company held that this was an infringement on its franchise, which has been upheld by the commission.

DETROIT, MICH.—Schwanbeck Brothers are reported to have purchased a tract of twelve acres on Westminster Avenue, between Russell Street and the Grand Trunk Railroad tracks, on which they propose to erect a plant for manufacturing showcases. A separate power plant will be erected. The equipment will consist of a 300-hp Corliss engine and generator. Part of the machinery will be equipped for electrical operation.

ESCANABA, MICH.—The Escanaba Traction Company is reported to be contemplating the construction of a second power dam on the Escanaba River. About 2000 hp will be developed.

MUSKEGON, MICH.—Owing to a disagreement between the City Council and the Muskegon Traction & Lighting Company, it is expected that the city will be without street-lighting service after June 1 until the new municipal lighting plant is completed. As yet the bonds have not been issued. The Council demands a reduction in the prices for street lamps, which the company refuses to make unless given a new contract for a term of five years.

RED LAKE FALLS, MINN.—The Red River Power Company is reported to be considering a proposition to supply the farmers in this vicinity with electricity for lamps and motors.

WAYZATA, MINN.—The Village Council has engaged W. D. Lovell, of Minneapolis, Minn., consulting engineer, to make investigations and prepare estimates as to the probable cost of installing a municipal electric-light plant and water-works system in Wayzata.

BELTON, MO.—The citizens are reported to have voted to install an electric-light system in Belton.

COLUMBIA, MO.—The City Council has awarded the contract for extensions to the municipal electric-light plant and water-works system to the John W. Danforth Company, of St. Louis, Mo., for $66,000. Shaw & Humphrey, Chemical Building, St. Louis, Mo., are consulting engineers.

BUTTE, MONT.—The City Council has authorized an extension to the curb cluster lamp-lighting system, to cost approximately $12,000.

LIBBY, MONT.—The Libby Water Works, Electric Light & Power Company, it is reported, is planning to install an electric-light plant in Libby, Mont.

KIMBALL, NEB.—The installation of an electric-light plant in Kimball is reported to be under consideration.

WYMORE, NEB.—The contract for the construction of the municipal power plant and office building is reported to have been awarded to Sidney Cornell, of Pawnee City, Neb.

RENO, NEV.—The Truckee River General Electric Company has commenced a suit against the farmers in the Truckee Valley for condemnation of rights of way over their lands for a high-voltage transmission line from the new power plant under construction at Verdi to Wabusha.

BLOOMFIELD, N. J.—The Town Council is reported to have engaged Runyon & Carey, engineers, of Newark, N. J., to make investigations and report on the feasibility of establishing a municipal electric-light plant in Bloomfield.

PHILLIPSBURG, N. J.—The Town Council has awarded a contract to the Easton Gas & Electric Company, of Easton, Pa., for lighting the streets of the town for a term of ten years.

TRENTON, N. J.—The Board of Public Utility Commissioners has given its approval of a proposed bond issue by the Riverside Traction of $137,125.

BINGHAMTON, N. Y.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until June 19, for installing a conduit and wiring system and extension of the present gas-piping system at the United States post office and courthouse in Binghamton, N. Y., in accordance with plans and specifications, copies of which may be obtained at the above office or at the office of the custodian of the building, Binghamton, N. Y. James Knox Taylor is Supervising Architect.

BUFFALO, N. Y.—The Public Service Commission, Second District, has authorized the Federal Telephone & Telegraph Company, of Buffalo, N. Y., to issue bonds to the amount of $578,000, the proceeds to be used for the purchase of the properties of the Niagara Home Telephone, the Dunkirk Home Telephone and the Independent Union Telephone Companies.

CATSKILL, N. Y.—The Catskill Illuminating & Power Company, of Catskill, and the Schoharie Light & Power Company have consolidated under the name of the Upper Hudson Electric & Railroad Company.

CORNING, N. Y.—The Corning & Painted Post Street Railway Company is reported to be preparing plans for an extension of its railway from Corning to North Corning. It is also proposed to double-track the Main Street line in Corning. The cost of the proposed improvements is estimated at about $40,000.

CORNING, N. Y.—The Corning Gas & Electric Company has submitted propositions to the Council to enter into a contract with the city for street lighting for a term of ten years, under the terms of which a saving of $7,000 will be effected and the efficiency of the street-lighting system greatly increased. The company also offers to furnish arc lamps

of the same type as those now in use under a five-year contract for $75 per lamp per year, or $72.50 for a ten-year contract. The price for incandescent lamps is to be reduced to $28 and $27.50 respectively. The city now pays $80 each per year for arc lamps. The company has also offered to install new luminous arc lamps under a ten-year contract at the rate of $75 each per year, and to furnish 75-watt incandescent lamps, for which the city now pays $30 per year, at $25 per lamp per year, and to supply a new-style lamp of 125 watts at the rate of $27.50 each per year.

NEW BRIGHTON, S. I., N. Y.—The contract for furnishing and placing lamp-posts on Jay and South Streets, retaining walls and curb lamp-posts on South, Jay and Hyatt Streets has been awarded to the Vulcan Railway Construction Company, 175 North Ninth Street, Brooklyn, N Y., for $24,057.

NEW YORK, N. Y.—The Manhattan Bridge Service Company has applied to the Board of Estimate for a franchise to construct an electric street railway from the Bowery and Canal Street, along Canal Street to the Manhattan Bridge and thence to Flatbush Avenue and Fulton Street, Brooklyn, N. Y.

NEW YORK, N. Y.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until June 12, for installation of electrically driven pumps in the United States post office and courthouse building at New York, N. Y. Plans and specifications may be obtained at the above office or at the office of the chief engineer and superintendent of repairs. James Knox Taylor is Supervising Architect.

NEW YORK, N. Y.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until June 12 for the installation complete of four new electric elevators in the United States post office and courthouse in accordance with plans and specifications, copies of which may be obtained at the above office or at the office of the chief engineer and superintendent of repairs of the building. James Knox Taylor is Supervising Architect.

NEW YORK, N. Y.—Frederick W. Whitridge, receiver of the Union Railway Company, has been authorized by Judge Lacombe, of the United States Circuit Court, to enter into a contract with the city for operating cars across the Madison Avenue bridge, to connect with the company's lines between East 136th and 138th Streets. A contract was also authorized for a double-track extension along Broadway, between 225th and 230th Streets, to connect the system of the Union Railway Company with the Kingsbridge Railway Company.

NEW YORK, N. Y.—Sealed bids will be received by C. B. J. Snyder, superintendent of school buildings, until June 12 for repairs, alterations and additions to the electric equipment in schools 2, 7, 34, 43 and 160, 6, 57, 58 and 74, Borough of Manhattan.

PLATTSBURG, N. Y.—The Plattsburg Gas & Electric Company has received authority from the Public Service Commission, Second District, to issue bonds to the amount of $10,000, to be sold at not less than 92, the proceeds to be used for extensions and improvements to its plant.

SCHENECTADY, N. Y.—Proposals will be received by the Board of Supervisors of Schenectady Countil until June 6 for furnishing and installing complete pneumatic water system, consisting of one electrically driven pump having a capacity of 200 gal. per hour, one electric motor, automatic starting device and pressure regulator and two 1500-gal. tanks.

SILVER CREEK, N. Y.—The question of purchasing the electric plant of the People's Electric Light & Power Company, to be owned and operated by the village, is reported to be under consideration.

SYRACUSE, N. Y.—The Board of Contract and Supply has awarded the contract for installing a central fire-alarm system in the Gamewell Fire Alarm Telegraph Company at $23,875. Work will be started at once on installation of the system.

SYRACUSE, N. Y.—The Public Service Commission, Second District, has authorized the Syracuse Lighting Company to issue $456,000 in bonds, of which the proceeds of $85,000 will be used for extensions and improvements to its electric system. Among the improvements contemplated is the erection of a new transformer station at East Syracuse, extension of a transmission line to Jamesville and the construction of a new station at Liverpool. James C. DeLong is general manager.

SYRACUSE, N. Y.—The Syracuse, Watertown & St. Lawrence River Railroad Company has applied to the Public Service Commission, Second District, for permission to construct a railway from a connection with the Syracuse & South Bay Electric Railroad in the town of Cicero to the village of Brewerton, a distance of 6 1-3 miles. The cost of the road is estimated at about $300,000. C. D. Beebe and William Nottingham, of Syracuse, N. Y., are interested in the company.

UTICA, N. Y.—The Board of Contract and Supply has awarded the contract for furnishing about 150,000 duct feet of tile and appurtenances for an extension of the electric subways in the city to the Safety Insulated Wire & Cable Company, of New York, N. Y., for $29,906. Stuart F. Day is secretary of board.

WHITE PLAINS, N. Y.—The Public Service Commission, Second District, has given the Hudson River Eastern Traction Company permission to build an electric railway in the village of Sherman Park, through the towns of Mount Pleasant and North Castle and into the village of White Plains, and to exercise its local franchises in these places. The company now has authority to construct an electric railway from Ossining to White Plains.

WOLCOTT, N. Y.—The Public Service Commission, Second District, has authorized the Northern Wayne Electric Light & Power Company to purchase the plant and holdings of the Wolcott Electric Light & Power Company in Wolcott for $33,000, and to issue capital stock to the amount of $75,000, the proceeds to be applied to the purchase of the property and to the erection of transmission lines authorized under its various franchises.

RALEIGH, N. C.—The Carolina Power & Light Company is reported to have secured the controlling interest of the Standard Gas & Electric Company, of Raleigh. Charles E. Johnson, of Raleigh, N. C., is president of the Carolina Power & Light Company.

WELDON, N. C.—The Virginia & Carolina Power Company, recently organized, it is reported, will take over and develop the water-power on Roanoke River, near Weldon, where it is estimated that about 25,000 hp can be developed. Electricity generated at this plant will be transmitted to Weldon and other North Carolina cities, to Petersburg, Va., 50 miles distant, and to Norfolk, Va., a distance of 70 miles. This development is connected with the consolidation of the Virginia Railway & Power Company, of Richmond, Va., and the Norfolk & Portsmouth Traction Company, of Norfolk and Portsmouth, Va. William C. Whitner will be president of the Virginia & Carolina Power Company.

NEW ENGLAND, N. D.—Preparations are being made by the North Dakota Independent Telephone Company to install a telephone exchange in New England.

CAMBRIDGE, OHIO.—The Midland Power & Traction Company, it is reported, is contemplating extending its lines to Pleasant City in the near future. W. A. Gibbs, of Cambridge, Ohio, is general manager.

FINDLAY, OHIO.—The farmers in the southern part of Hancock County have organized a company to build an independent telephone system connecting about forty towns. Christian Hilty is president, J. W. Shilling vice-president, and Noah O. Blossom treasurer.

CUSTER, OKLA.—The Western Engineering Company, of Oklahoma City, Okla., it is reported, is preparing plans for the installation of an electric-light plant and water-works system in Custer, to cost approximately $40,000.

PANAMA.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until June 22, for furnishing cargo-handling and locomotive cranes, gasoline-engine-driven passenger car, rock skips, caplets, electric cable and cable terminals as per Circular No. 634. Blanks and general information relating to the above circular may be obtained from this office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Captain F. C. Boggs is general purchasing officer.

MOUNT UNION, PA.—The capital stock of the Mount Union Light & Power Company has been increased from $25,000 to $60,000.

PHILADELPHIA, PA.—Bids will be received at the office of the Commanding Officer, Frankford Arsenal, Philadelphia, Pa., until June 5, for furnishing and installing a one-ton electric traveling crane in the scrap storehouse at Frankford Arsenal, Philadelphia, Pa.

PHILADELPHIA, PA.—Contracts have been awarded by the Cumberland Valley Railroad Company for equipping its signal system with electric lamps on 43 miles of double track. Alternating-current, 3300-volt, 25-cycle, three-phase system will be used. It is proposed to carry sufficient current in the signal mains to supply electricity to light all of the stations.

PHILADELPHIA, PA.—The Philadelphia Railways Company, recently incorporated, will take over the property of the Southwestern Street Railway Company, which was sold under foreclosure sale on April 21. The new owners, it is said, will re-equip the railway, enlarge the power plant and generally rehabilitate the entire system. The motor cars will be increased to twenty-five. The company is capitalized at $400,000. Isaac H. Silverman is president and Alvin H. From secretary. The offices of the company are located at 605 Land Title Building, Philadelphia, Pa.

PUNXSUTAWNEY, PA.—The Jefferson Electric Light, Heat & Power Company has increased its capital stock from $25,000 to $100,000.

ESTELLINE, S. D.—The Council is reported to have granted a franchise for the installation of an electric-light plant in Estelline, S. D.

FAITH, R. F. D. LEMMONVILLE, S. D.—It is reported that Mills & Harrington are contemplating the installation of a 100-kw electric-light and power plant, to cost approximately $10,000. M. E. Bookman, of Eagle Butte, S. D., is engineer.

MOBRIDGE, S. D.—Plans are being considered by the Chicago, Milwaukee & Puget Sound Railway Company to install a telephone system for dispatching trains between Mobridge, S. D., and Deer Lodge, Mont., a distance of 775 miles.

PIERRE, S. D.—The contract for installing conduits for electric-light wires in the State Capitol grounds has been awarded to Nimis & Nimis, of St. Paul, Minn., for $1,440. H. B. Anderson is State Auditor.

DYERSBURG, TENN.—Sealed proposals will be received by the City Water and Light Department, Dyersburg, Tenn., until June 13, for equipment for extensions to the municipal electric-light plant, including engines, boilers, generators and switchboard equipment. Specifications may be obtained upon application to the City Light and Water Department, or to M. W. Ewell, Mayor.

GREENVILLE, TENN.—At an election to be held June 5 the proposition to issue $65,000 in bonds, the proceeds to be used for the construction of an electric-light plant and water-works system, will be submitted to a vote of the people.

McKENZIE, TENN.—The city of McKenzie, Tenn., it is said, will ask for bids about July 1 for the construction of an electric-light plant. Bonds to the amount of $40,000 were recently voted, the proceeds to be used for construction of an electric-light plant, water-works system and street improvements. C. H. Jenks, of St. Louis, Mo., is engineer.

BROWNWOOD, TEX.—Dr. M. M. Scott, who recently purchased the town site of Owens, near here, is reported to be contemplating extensive improvements, including the installation of public utility plants.

CUERO, TEX.—The Cuero Light & Power Company, it is reported, is contemplating the installation of a 1200-hp water-wheel and electrical equipment, which will double the output of its plant. E. J. Hayes Company, of Houston, Tex., has the contract for the work.

EL PASO, TEX.—Permits have been secured by the El Paso Electric Railway Company for the erection of an addition to its power house in El Paso, the cost of which is estimated at $83,290.

TERRELL, TEX.—Plans are being made by the city for the construction of a municipal electric-light plant, for which, it is said, bids have been received.

MAYFIELD, UTAH.—The Gunnison Valley Power Company, of Gunnison, Utah, has been granted a franchise to supply electricity in Mayfield.

RICHFIELD, UTAH.—The Telluride Power Company, of Provo, Utah, has purchased the plant and holdings of the Richfield Electric Light & Power Company. The Telluride company will take over the entire system, including the steam plant, water system and water power at Glenwood and distributing system in both cities.

FT. ETHAN ALLEN, VT.—Bids will be received at the office of the Quartermaster, Ft. Ethan Allen, Vt., until June 21 for building addition to pump house, installing electrically operated pumping machinery, building concrete reservoir and remodeling electric-lighting system. Captain R. J. Fleming is quartermaster.

BEDFORD CITY, VA.—Plans are being considered by the city for the installation of a 1200-hp hydroelectric power plant to supply electricity for small manufacturing plants.

RICHMOND, VA.—The contract for wiring the United States post office in Richmond, Va., is reported to have been awarded to the Atlantic Electric Company, of Norfolk, Va., at $7,924. James Knox Taylor is supervising architect.

RICHMOND, VA.—It is reported that the city is contemplating the installation of electric pumps at the old pumping station, to be connected with the standpipe service. The cost is estimated at $16,000. Charles E. Bolling is city engineer.

SEATTLE, WASH.—Proposals will be received at the office of the Constructing Quartermaster, 482 Arcade Annex, Seattle, Wash., until June 15, for the construction of an electric lighting system at Ft. Flagler, Wash. Plans and specifications may be obtained on application to Captain E. C. Long, Constructing Quartermaster. A deposit of $10 will be required which will be refunded on return of the plans.

SPOKANE, WASH.—Plans are being considered by the Washington Water Power Company to complete its Little Falls power plant, the extension of many of its distributing lines in Spokane, the installation of storage batteries, extensions to its underground conduit system and the completion of its transmission line from Post Falls to Newport.

HUNTINGTON, W. VA.—It is reported that arrangements have been completed by the American Railways Company, of Philadelphia, Pa., for taking possession of the properties of the Ohio Valley Electric Railway Company. Bonds to the amount of $2,000,000 will be issued by the American Railways Company, of which $1,700,000 will be given in exchange for the stock of the Ohio Valley Electric Company, and $300,000 will be held for extensions and improvements to the new lines.

MARTINSBURG, W. VA.—It is reported that arrangements are being made by the Martinsburg Power Company for the installation of a 1500-hp steam turbine. H. B. Shoemaker is manager.

BARABOO, WIS.—The Baraboo Gas & Electric Company has been authorized by the State Railroad Commission to issue $100,000 in capital stock and bonds to the amount of $98,000. The total issue is to be made to Frank R. Glover, T. H. Durst and William Clancy on completion of the organization of the Baraboo Gas & Electric Company to take over the property, franchises, etc., of the Baraboo Lighting Company, which were acquired through a foreclosure sale. The total outstanding indebtedness of the latter company at the time of the sale was said to be $198,000.

FOND DU LAC, WIS.—Plans are being made by the business men to install ornamental lamps on Main Street from Division to Fourth Street, for which subscriptions are now being taken.

BASSANO, ALTA., CAN.—It is reported that the town of Bassano, located midway between Calgary and Medicine Hat, will be supplied with electricity from the hydroelectric plant of the Canadian Irrigation Company, which is building a large dam, for irrigation purposes, at a cost of about $7,000,000. Turbines capable of generating 28,000 hp are now being installed.

CALGARY, ALTA., CAN.—Arrangements are being made by the Alberta Electric Railway Company for the construction of its proposed electric railway to extend from Medicine Hat to Banff, work on which will begin at once. The proposed railway will be 79 miles in length. The headquarters of the company will be located in Calgary. The company is capitalized at $10,000,000.

STETTLER, ALTA., CAN.—The ratepayers have voted in favor of the by-law to install an electric-light and power plant in Stettler. A plant with sufficient output to provide for 2500 lamps of 16 cp will be erected, work on which will begin at once.

NELSON, B. C., CAN.—It is reported that application will be made on June 16 for permission to use 6300 cu. ft. of water per second from the Kootenay River at Granite, 4 miles below Nelson, to be utilized for power purposes. The proposed work will include construction of dam, canal and power house. A. L. McCulloch, of Nelson, mining engineer, and W. F. Teetzel, water commissioner for this district, are said to be interested in the project.

REVELSTOKE, B. C., CAN.—It is reported that the Diamond Mills Company and the Dominion Securities Company have purchased a large tract of standing timber near Revelstoke, B. C., and will begin immediately the development of a large water-power development and a large paper and pulp mill a few miles from Revelstoke. The project will involve an expenditure of about $20,000,000 and include the construction of an electric railway connecting the mills with the town. Charles A. Barnum, of Chicago, Ill.; F. C. Adams, of Duluth, Minn., and Charles E. Stone, of St. Paul, Minn., are interested in the project.

VICTORIA, B. C., CAN.—It is reported that the City Council is asking bids for 300 electric-lamp standards for street-lighting purposes.

HALIFAX, N. S., CAN.—The City Council has adopted a resolution authorizing plans and specifications prepared for the construction of an incinerating plant, to cost about $40,000. It is proposed to generate power at the plant to operate a stone crusher and other small machines.

NICTAUX FALLS, N. S., CAN.—The Canada Iron Corporation, of Montreal, Que., Can., it is reported, is building a hydroelectric power plant, at a cost of $70,000, in connection with its iron mines, and also a washing plant, to cost $75,000. E. M. Archibald, of Nictaux Falls, is engineer.

FT. WILLIAM, ONT., CAN.—Tenders will be received by the City Clerk, addressed to the chairman of the utilities committee, Ft. William, Ont., Can., until July 1, for the sale of equipment of the municipal pumping and electrical generating plant, which has been thrown out of use by the hydroelectric power and gravity water system, and would be suitable for a town with a population of 5000. The equipment includes two duplex compound pumps having a capacity of 600 gal. per minute; one tandem compound engine; one engine with countershafting, pulleys and belting complete; one Westinghouse revolving-field 600-kw, two-phase, 60-cycle, 2400-volt generator with exciter, switchboard, etc.; one Royal Electric 180-kw, 133-cycle, 2400-volt generator with exciter, switchboard, etc. Machinery can be inspected any time at the municipal power house, Ft. William, Ont. John Wilson is city engineer.

GALT, ONT., CAN.—A by-law authorizing an expenditure of $25,000 for the extension of the hydroelectric power system in Galt was passed by the ratepayers at an election held May 26. It is proposed to extend the residential lighting service, provide equipment for service to manufacturing and industrial plants and for extensions to the street lighting system.

GODERICH, ONT., CAN.—Representatives from the town of Goderich and other villages in this vicinity have submitted a proposition to the Hydroelectric Power Commission to build a dam on the Maitland River near Goderich to supply power to generate electricity for Goderich and surrounding territory. The cost of the work is estimated at about $300,000. It is proposed that the municipalities of Goderich and Huron develop the power and distribute it on the same basis as the Hydroelectric Power Commission.

LONDON, ONT., CAN.—The City Council is reported to be considering the question of installing 200 additional street lamps.

OTTAWA, ONT., CAN.—It is reported that the Grand Trunk Railway Company is planning to erect new coal chutes east of the company's car shops, to cost about $15,000. Electrical power will be used.

JONQUIERE, QUE., CAN.—It is reported that the Price Brothers Company will be in the market for machinery and equipment for its new pulp mills to be erected in Jonquiere, consisting of water-wheels, generators, penstocks, etc. The cost of the equipment is estimated at about $300,000. R. S. Kelsch is consulting engineer.

MAGOG, QUE., CAN.—Plans are being made for the construction of a new power plant to be built jointly by the town and the Dominion Textile Company. The proposed plant will supply electricity for lamps and motors for the town, and the surplus will be used at the mills of the Dominion Textile Company. R. S. Kelsch, Power Building, Montreal, Que., has been engaged as consulting engineer by the company. T. Pringle & Son will represent the town.

MONTREAL, QUE.—It is reported that a new power house and laundry will be erected for the Windsor Hotel. The power house will have an output of about 800 hp. R. S. Kelsch is consulting engineer.

MONTREAL, QUE., CAN.—The Canadian Light & Power Company has purchased the plant and holdings of the Central Light, Heat & Power Company, of Montreal, Que. The price paid for the property is said to be about $500,000. The plant of the Central company will give the Canadian Light & Power Company means to supply and distribute electricity in the city of Montreal immediately.

MONTREAL, QUE., CAN.—Tenders will be received by the Board of Commissioners of the city of Montreal, Que., until June 29 for fur-

nishing and installing pumping machinery, rotary blower and cranes in and about one proposed low-lift pumping station of the filtration plant, consisting of fourteen centrifugal pumps, direct-connected to electric motors as follows: Four pumps having a capacity of 17,500 imperial gal. per minute each, 18 ft. lift; two pumps having a capacity of 11,600 imperial gal. per minute each, 18 ft. lift; two pumps having a capacity of 58000 imperial gal, per minute each, 18 ft. lift; two pumps having a capacity of 1300 gal. per minute each, 46 ft. lift; two pumps having a capacity of 330 imperial gal. per minute each, 15 ft. lift; two pumps having a capacity of 150 imperial gal. per minute each, 15 ft. lift; one rotary blower, direct-connected to an electric motor, having a capacity of 5000 ft. of air against 5 lb. per square inch pressure, and two 6-ton hand-operated traveling cranes. Plans and specifications are on file at the office of the Chief Engineer of Public Works, Montreal, and at the office of Hering & Fuller, 170 Broadway, New York, N. Y. L. N. Senecal is secretary of Board of Commissioners.

New Industrial Companies.

THE AUTOMATIC ELECTRIC LIGHT & POWER COMPANY, of Chicago, Ill., has been granted a charter, with a capital stock of $250,000, for the purpose of manufacturing electrical and other appliances. The incorporators are: M. W. Zabel, O. M. Wermich and H. Jones.

THE CENTURY RAILWAY EQUIPMENT COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $160,000, to do a general contracting business and to deal in railroad equipment.

THE ELECTRIC SMELTING & REFINING COMPANY OF MEXICO has filed articles of incorporation under the laws of the State of New Jersey, with a capital stock of $500,000. The company proposes carrying on the business of smelting and refining metals, etc. The incorporators are: J. H. Reid, L. P. Adams and C. H. Slease, all of Newark, N. J.

THE ELECTRIC SPIRITS AGING COMPANY, of Chicago, Ill., has been incorporated by M. C. Olson, C. W. Howe and B. Levering. The company is capitalized at $50,000 and proposes to carry on a business of aging and coloring liquors and spirits by an electrical process.

THE ELECTRIC WEIGHING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $50,000, by E. H. Messiter, J. A. Byrne and H. G. Pierce, of New York, N. Y. The company proposes to manufacture electric weighing apparatus.

THE FRANCO-AMERICAN ELECTRIC NOVELTY COMPANY, of New York, N. Y., has been incorporated by John Smith, 318 East Thirty-first Street; Samuel I. Posen, 1130 Union Avenue, and Mordych L. Kaplan, of 1130 Union Avenue, all of Buffalo, N. Y. The company is capitalized at $40,000 and proposes to manufacture electrical novelties and supplies.

THE GRAFTON ELECTRICAL CONSTRUCTION COMPANY has been organized, with a capital stock of $5,000, by William Ile and others. The company proposes to do a general electrical contracting business.

THE LEE MACHINE COMPANY, of New Haven, Conn., has been incorporated with a capital stock of $150,000 by Henry B. Lee, of New London, Conn.; Winthrop G. Bushnell and Samuel C. Morehouse, of New Haven, Conn. The company proposes to manufacture the Lee steam turbine.

THE MOTOR EQUIPMENT MANUFACTURING COMPANY, of Kansas City, Mo., has been chartered, with a capital stock of $10,000, for the purpose of manufacturing motor equipment. The incorporators are: George B. Maegly, P. R. Toll, L. L. Seibel and others.

THE MURPHY EQUIPMENT COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $100,000, and proposes to manufacture and sell railway equipment, etc. The incorporators are: Albert C. Murphy, 600 West 142d Street; John H. Allen, 523 143d Street, New York, N. Y., and Franklin M. Patterson, 1124 Avenue C., Bayonne, N. J.

THE NATIONAL COMBUSTION COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $30,000, for the purpose of manufacturing boilers, furnaces, factory and foundry supplies. The incorporators are C. M. Gilpin, J. J. McKenna and J. M. Wright, all of New York, N. Y.

THE ST. LOUIS AUTOMOBILE & ENGINE COMPANY, of St. Louis, Mo., has been incorporated, with a capital stock of $50,000, by W. D. Williams, Charles F. Keene and Frank H. Braden. The company proposes to manufacture a patented rotary engine for automobiles and other purposes.

New Incorporations.

MANSFIELD, ARK.—Articles of incorporation have been filed for the Modern Electric Light & Power Company with a capital stock of $100,000. The officers of the company are: C. E. Brice, president; N. Hudson, vice-president; G. E. Gilmore, secretary, and J. C. Wheeler, treasurer.

EL MONTE, CAL.—The El Monte Light & Water Company has been chartered, with a capital stock of $25,000, by A. F. Snell, I. T. Baker, G. H. Coffin, S. Shirpser and M. Kauffman.

SACRAMENTO, CAL.—The Sacramento-Folsom Electric Railway Company has filed articles of incorporation with a capital stock of $1,000,000 to build an electric railway from Sacramento to Folsom, a distance of 22 miles, and a branch line, 4 miles in length, out from the Fair Oaks bridge. The incorporators are: Francis V. Keesling, Herman H. Grau, Ernest L. Brune, J. W. Cook and Otto Grau.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Sacramento-Sierra Power & Water Company with a capital stock of $2,000,000 by C. C. Chapman, C. L. Barsotti, John Muldoon, Dudley Smith and C. J. Lancaster.

MOODUS, CONN.—The Moodus & East Hampton Electric Railroad Company has been incorporated for the purpose of building an electric railway to connect Moodus, East Hampton and Marlboro Mills. E. W. Crocker, of Moodus, is interested in the project.

HAZLETON, IND.—Articles of incorporation have been filed for the Consolidated Light & Power Company with a capital stock of $15,000. The company proposes to supply electricity for lamps and motors in the towns of Hazleton and Potaka. The incorporators are: Ethelbert Curtner, Jesse D. Doty and James F. Breithaupt.

ELLISVILLE, MISS.—The Jones County Rural Telephone Company has been incorporated with a capital stock of $10,000 by W. N. Montgomery, J. O. Freeman and others.

MOBERLY, MO.—The Randolph County Gas & Electric Company has filed articles of incorporation with a capital stock of $100,000 by Thomas F. Fulkerson, Walter C. Duncan and James T. Menefee.

RALEIGH, N. C.—The North State Hydro-Electric Company has been incorporated with a capital stock of $300,000 by A. C. Wykoff, H. L. Parker and F. H. Briggs. The company proposes to erect a hydroelectric power plant and transmission system.

TOWNSVILLE, N. C.—The Northwestern Telephone & Telegraph Company has been incorporated, with a capital stock of $10,000, by G. W. Morrow, J. J. White and W. B. Chapin.

FRANCIS, OKLA.—Articles of incorporation have been filed for the Francis Light & Power Company, with a capital stock of $10,000, by W. P. Chism, Albert Goetter, W. L. Shaffer and others.

CANBY, ORE.—The Willamette & Mollala Valley Railway Company has been chartered with a capital stock of $250,000 to build an electric railway from the Willamette River up the Mollala Valley to Canby, a distance of 12.5 miles. W. J. Lee, of Canby, Ore., is manager.

AVIS, PA.—The Avis Light, Heat & Power Company has been chartered with a capital stock of $5,000. The directors are: W. Harry Baker, of Harrisburg, Pa., treasurer; Charles E. Covert, of Harrisburg, Pa.; Thomas R. Harter, of Loganton, Pa.; Luther M. Patterson, C. Fred Kreamer, James M. Miller and W. H. Klapp, all of Lock Haven, Pa.

EPHRATA, PA.—The Denver & Ephrata Telephone & Telegraph Company has been chartered with a capital stock of $35,000 and the following directors: C. J. Martin, of Martindale, Pa., treasurer; A. N. Landis, Ephrata, Pa.; W. F. Brossman, Stevens, Pa., and others.

HARBOR CREEK, PA.—The Harbor Creek Township Electric Company has been granted a charter, with a capital stock of $10,000. The directors are: R. W. Mott, 2031 East Chelten Avenue, Philadelphia, Pa., treasurer; George Gray, Jr., of Wilmington, Del.; G. W. Wallace, and J. J. Hope, of Philadelphia, Pa.

HARRISBURG, PA.—The Willistown Electric Company has been incorporated, with a capital stock of $5,000, and the following directors: George V. Smith, 2029 Pine Street, Philadelphia, Pa., treasurer; John Eliason and Howard Kirk, all of Philadelphia, Pa.

HARRISBURG, PA.—The Northeast Borough Lighting Company has been chartered with a capital stock of $10,000. The directors are: R. W. Mott, 2031 East Chelten Avenue, Philadelphia, Pa., treasurer; W. Marriott Canby and G. W. Wallace, of Philadelphia, Pa.

HARRISBURG, PA.—A charter has been granted to the Bucks County Light Company, with a capital stock of $5,000. The directors are: Harry W. Stoll, Cape May Court House, N. J., treasurer; John F. Lederach, of Lederach, Pa., and Fred H. Souder, of Lansdale, Pa.

HARRISBURG, PA.—The Northeast Township Company has filed articles of incorporation, with a capital stock of $10,000. The directors are: R. W. Mott, 2031 East Chelten Avenue, Philadelphia, Pa., treasurer; W. Marriott Canby, F. C. McCown, Jr., of Germantown, Philadelphia, Pa., and E. C. Batchelor, Mount Airy, Philadelphia, Pa.

HARRISBURG, PA.—Articles of incorporation have been filed with the Secretary of State for the Waldameer Electric Light Company, with a capital stock of $10,000. The directors are: R. W. Mott, 2031 East Chelten Avenue, Philadelphia, Pa, treasurer; William R. Wenstrom, of Philadelphia, Pa., and Joseph E. Mager, of Haddonfield, N. J.

HARRISBURG, PA.—Charters have been granted by the Secretary of State to the East Goshen Electric Company; the East Whiteland Electric Company, and the West Whiteland Electric Company. Each company is capitalized at $5,000 and the directors are: George V. Smith, 2029 Pine Street, Philadelphia, Pa., treasurer; Howard Kirk and John Eliason, all of Philadelphia, Pa.

HARRISBURG, PA.—Charters have been granted by the Secretary of

State to the Clinton Light Heat & Power Company, the Patterson-Scootac Light, Heat & Power Company, the Susquehanna Light, Heat & Power Company and the West Branch Light, Heat & Power Company. Each company is capitalized at $5,000 and the directors are: W. Harry Baker, of Harrisburg, Pa., treasurer; Charles E. Covert, of Harrisburg, Pa.; Thomas R. Harter, of Loganton, Pa.; Luther M. Patterson, C. Fred. Kreamer, James M. Miller and W. H. Klapp, all of Lock Haven, Pa.

HARRISBURG, PA.—Charters have been granted by the Secretary of State to the following companies: The Warwick Township Electric Company; the Warminster Township Electric Company; the Whitpain Township Electric Company; the Upper Dublin Township Electric Company; the Southampton Township Electric Company, and the Horsham Township Electric Company. Each company is capitalized at $5,000, and the directors are: W. T. Robinson, of Philadelphia, Pa., treasurer; M. W. Stroud, of Philadelphia, Pa., and R. R. Van Horn, of Plymouth, Pa.

HARRISBURG, PA.—Charters have been granted by the Secretary of State to the following companies: The West Wyoming Electric Company; the Warrior Run Electric Company; the Union Township Electric Company; the Shickshinny Electric Company; the Pringle Township Electric Company; the Larksville Electric Company; the Lehman Township Electric Company; the Lake Township Electric Company; the Jackson Township Electric Company; the Hunlock Township Electric Company, and the Gas Company of the West Side. Each company is capitalized at $5,000 and the directors are: W. T. Robinson, of Philadelphia, Pa., treasurer; M. W. Stroud, of Philadelphia, Pa., and W. C. Anderson, of Kingston, Pa.

HARRISBURG, PA.—Charters have been granted by the Secretary of State to the following electric companies: The Albion Electric Company, the Beechwood Electric Company, the Diamond Electric Company, of Washington Township, Pa.; East Allen Electric Company; Excelsior Electric Company, of Plainfield Township; Equitable Electric Company, of Whitehall Township; Greenwood Electric Company; Hazard Electric Company; Lower Mount Bethel Electric Company; Lehigh Navigation Electric Company; Moore Township Electric Company; Newquehoning Electric Company; North Whitehall Electric Company; Oakdale Electric Company; Orchard Electric Company; Panther Creek Electric Company; Primrose Electric Company; Standard Electric Company, of Washington Township; Skidmore Electric Company; Star Electric Company; South Whitehall Electric Company; Upper Nazareth Electric Company; Upper Mount Bethel Electric Company; Upper Macungie Electric Company, and Upper Milford Electric Company. Each company is capitalized at $10,000 and the directors are: H. F. Baker, of Germantown, Pa., treasurer; W. A. Lathrop, of Dorrance, Pa., and R. H. Wilbur, of St. Davids, Pa.

HOMESTEAD, PA.—The Mahan Electric Company has filed articles of incorporation with the Secretary of State with a capital stock of $5,000. The directors are: F. J. Taylor, of Homestead, Pa., treasurer; A. E. DuBois, of Pittsburgh, Pa., and A. L. Davis, of Oakland, Pa.

McKEESPORT, PA.—Articles of incorporation have been filed for the Penn Borough Electric Company with a capital stock of $5,000. The directors are: H. C. Miller, of McKeesport, Pa., treasurer; C. W. Scheck, of Mount Lebanon, Pa.; and F. J. Taylor, of Homestead, Pa.

MOUNTAIN, PA.—The Mountain Electric Light, Heat & Power Company has been chartered with a capital stock of $10,000. The directors are: Walter W. Perkins, of Philadelphia, Pa., treasurer; Scott S. Crane, of Altoona, Pa.; C. L. S. Tingley, of St. Davids, Pa.; Frank T. Pryor, Jr., and Joseph M. Walsh, of Philadelphia, Pa.

MOUNT CARMEL, PA.—The Mount Carmel Light, Heat & Power Company has been incorporated with a capital stock of $50,000. The directors are: B. F. Christ, of Mount Carmel, Pa., treasurer; J. E. Nastress, C. H. Robins, C. L. Cleaver and C. A. Goldschmidt, all of Mount Carmel.

NORRISTOWN, PA.—The Tredyffrin Electric Company has been chartered with a capital stock of $5,000. The directors are: Herbert H. Ganser, of Norristown, Pa., treasurer; Daniel A. Bertolette and Montgomery Evans, of Norristown, Pa.

PITTSBURGH, PA.—The Beaver Northern Street Railway Company has been chartered with a capital stock of $30,000. The directors are: J. S. Herron, of Pittsburgh, Pa., president; E. A. Morton, of Dravosburg, Pa.; F. J. Lobert, John F. Hayes and Charles Pederson, all of Pittsburgh, Pa.

SHAMOKIN, PA.—The Black Diamond Electric Company has filed articles of incorporation with the Secretary of State with a capital stock of $5,000.

SMITHTON, PA.—The Smithton Light, Heat & Power Company has been incorporated with a capital stock of $20,000. The directors are: Van A. Reed, Jr., of Elizabeth, Pa., treasurer; Joseph Boves, of Smithton, Pa.; Thomas H. Verner, of McKeesport, Pa.; George M. Keefer, of Pittsburgh, Pa., and David E. Brown, of Cresson, Pa.

STEELTON, PA.—The Swatara Electric Light Company has been granted a charter with a capital stock of $5,000. It is understood that the company proposes to erect a plant in Steelton. The incorporators are: J. W. Carpenter, W. T. Reynolds and Fred E. Scott, all of Scranton. The office of the company is located in Scranton.

WARREN, PA.—Articles of incorporation have been filed for the Warren Light & Power Company with a capital stock of $10,000. The directors are: C. T. Conarro, of Warren, Pa., treasurer; R. G. Chapel, F. B. Jackson and C. B. Ayers, all of Warren, Pa.

Personal.

MR. C. A. TUPPER, of Milwaukee, Wis., has returned home from a lengthy trip abroad, during which he visited North Africa and all of Europe west of Russia, except the Scandinavian countries.

MR. HENRY FLOY delivered an illustrated lecture on May 25 before the Cornell University Club, New York, on the subject of the Panama Canal, which he recently visited with the party of members of the American Society of Civil Engineers.

MR. DONALD MURRAY is the author of a paper entitled "Practical Aspects of Printing Telegraphy," presented at the May meeting of the British Institution of Electrical Engineers. The paper contains a complete exposition of the latest type of the Murray printing telegraph.

MR. EVAN PARRY, who has been associated with Dr. H. F. Parshall during the past eighteen years, has been appointed electrical adviser to the New Zealand government. On May 6 a farewell dinner was tendered to Mr. Parry in London, at which eighty of the leading electrical men of Great Britain were present.

PROF. RICHARD MULLER, head of the department of electrical engineering at the University of Quito, has been appointed by the government of the Republic of Ecuador as its delegate to the Turin International Electrical Congress. Prof. Muller, who also acts as consulting engineer to the government, sailed from Guayaquil May 29 for New York, where he will embark, after a short stay, for Italy.

MR. L. H. NEUBERT, manager of the Redwood district of the Pacific Gas & Electric Company, will on June 1 take charge of the company's new-appliance department, with headquarters at San Francisco. To fill the vacancy caused by his appointment, E. W. Florence, district manager of the Pacific Gas & Electric Corporation at Fresno, has been transferred to the Redwood district. W. H. Henderson, manager of the Colusa district, has been transferred to Fresno.

MR. ALTEN S. MILLER has tendered his resignation as president and general manager of the Union Electric Light & Power Company, of St. Louis, to rejoin Dr. Alex C. Humphreys, of Hoboken, N. J., with whom he was associated a number of years ago. Mr. Miller's resignation is to take effect July 1, after a service of two years with the Union company. A farewell banquet will be given in his honor at the Southern Hotel, St. Louis, June 27, by the St. Louis League of Electrical Interests and the local branch of the National Electric Light Association.

MR. C. H. ANDREWS has been appointed manager in charge of the North Carolina Public Service Company's properties at Greensboro and High Point, N. C., furnishing electric-lighting, gas and street-railway service in these cities. Mr. Andrews was graduated from Purdue University in 1908, and entered the employ of the North Carolina company two years ago as a meter reader and tester. Since then he has been successively placed in charge of the electric-lighting, commercial and gas departments, finally succeeding Mr. E. C. Deal as local manager, following the latter's transfer to Atlanta, Ga.

MR. ROBERT T. LINCOLN, first vice-president of the Commonwealth Edison Company and a director in the Chicago Telephone Company, on May 18 presented his resignation as president of the Pullman Company, a position which he has held since 1897. Following the acceptance of his resignation, Mr. Lincoln was elected chairman of the board of directors of the company. Mr. Lincoln, who is now sixty-eight years of age, is a son of Abraham Lincoln and was born at Springfield, Ill., August 1, 1843. During the civil war he served as captain under General Grant. He was admitted to the Chicago bar in 1867. From 1881 to 1885 he was Secretary of War, and from 1889 to 1893 served as United States Minister to Great Britain.

MR. GEORGE R. FIELD, assistant general manager of the Great Western Power Company, has resigned his position, to take effect July 1. This follows the resignation of H. R. Sinclair as general manager of the same company, announced recently, Mr. Field having decided on his action at the same time. Mr. Sinclair and Mr. Field will retain a connection with the company in its construction work contemplated on the Feather River, as the plans for this work were prepared by them and it is the desire of the officials of the company that the actual work be done under their direction. In addition to his other duties, Mr. Field has had general direction of the construction work of the company for the past two years, including the large concrete dam at Big Bend, Feather River, finished last November.

MR. G. H. STICKNEY has been placed in charge of illuminating engineering work at the incandescent lamp sales office of the General Electric Company at Harrison, N. J. Mr. Stickney graduated from the electrical engineering course at Cornell University in 1896, and immediately thereafter entered the student course offered by the General Electric Company at Schenectady, N. Y. In February, 1898, he was transferred to the Lynn (Mass.) factory of the company. As a result of some suggestions tending to simplify and improve the photometric work, Mr. Stickney was placed in charge of the photometric tests under Mr. W. D. A. Ryan, and has devoted his time to the solution of problems relating to both arc and incandescent lighting. He has assisted Mr. Ryan in the design of light-measuring instruments as well as diffusers and reflectors and was responsible for the introduction of the radial reflector for street lighting. For the past three years a large part of his time has been devoted to consulting illuminating engineering.

MR. GEORGE BELL, formerly with the Westinghouse Electric & Manufacturing Company, has become associated with the Duncan Elec-

tric Manufacturing Company, of Lafayette, Ind., as sales manager. Mr. Bell prepared for college at Mercersburg Academy at Mercersburg, Pa., and took the electrical engineering course at Lafayette College, at Easton, Pa. Upon leaving college he entered the apprenticeship course of the Westinghouse Electric & Manufacturing Company, and after spending a year and a half in its shops entered the sales department, spending some time in the offices at East Pittsburgh, and later joined the sales force in the Atlanta office. After spending eight months there he was transferred to the Cincinnati office. In the fall of 1906 Mr. Bell was sent to Indianapolis to build up his company's business in Indiana, and the following spring opened the Indianapolis office, where he remained in charge until he resigned his position in October, 1910, to get some experience in central-station work. Mr. Bell has acquired an interest in the Duncan Electric Manufacturing Company.

Obituary.

MR. JAMES RUTHERFORD GORDON died from heart disease May 16 at Savannah, Ga. Mr. Gordon was born in Canada fifty years ago and was connected with the sales department of the Westinghouse Electric & Manufacturing Company for a period of twenty-five years, acting as district manager for the Southeastern States with headquarters in Atlanta for twelve years. In 1908 he resigned to take charge of the power apparatus department of the Western Electric Company in the Southern territory, acting as power apparatus manager. After a year and a half with this company, he resigned to take up hydroelectric development work. He is survived by his wife and a son, John H. Gordon. The interment took place at McKeesport, Pa., May 21.

Trade Publications.

OIL-BREAK SWITCHES FOR MANHOLE SERVICE.—The General Electric Company in Bulletin No. 4831 describes briefly a type of oil switch suitable for installing in manholes. These switches are made single, double or triple-pole, single-throw, and are for use on circuits on voltages up to 7500. The normal current rating is 200 amp.

FLOW METERS.—Bulletin Nos. 4826 and 4827, just issued by the General Electric Company, describe that company's water and air-flow meters, respectively. The water-flow meter provides a means of obtaining accurate information which will show the amount of water pumped, consumed or distributed, while the air-flow meter provides accurate information to be obtained as to the exact amount of air compressed or distributed.

SWITCHBOARD INSTRUMENTS.—The General Electric Company has recently issued Bulletin No. 4825, which illustrates and describes a line of compact, accurate and moderate-priced instruments for use on alternating-current and direct-current switchboards. The bulletin contains dimension diagrams and also illustrations showing the actual size of the meter scales. These illustrations will enable a prospective customer to see at a glance the ease with which readings may be made.

DRAWN-WIRE FILAMENT MUTIPLE LAMPS.—Bulletin 13 A of the engineering department of the National Lamp Association has for subject "Mazda" multiple-filament lamps with drawn-wire filaments, which are made for 100 volts, 125 volts and 200 volts, 25 watts to 500 watts. The various forms of bulbs are shown in good illustrations, and curves are given showing relation of life to candle-power, candle-power to voltage, and comparing the new lamp to older types. Information is also contained relating to the use of the burner in illumination calculations.

PULSOMETERS.—"The Pulsometer" is the title of an attractive handbook recently issued by the Pulsometer Steam Pump Company, of 17 Battery Place, New York City. The book is illustrated with numerous recent photographs showing the pulsometer employed for different kinds of work, and explains fully the operation and construction of the appparatus. Paragraphs explain the special adaptability of the Pulsometer for a variety of uses and the tables on pipe sizes, loss of head due to friction in pipes and other data on the flow and pumping of water should interest engineers.

ALTERNATING-CURRENT SWITCHBOARD PANELS.—The General Electric Company has just issued Bulletin No. 4819, which is devoted to the subject of alternating-current switchboard panels. The panels described are equipped with oil switches and are suitable for general use in central stations and isolated plants. They are designed for use with one set of busbars, to which all generators and feeders are connected by means of single-throw oil switches, and suitable provision is made for parallel operation. They are for use on three-phase three-wire circuits of 480 volts and 600 volts and 25 cycles to 60 cycles.

ELECTRICAL SUPPLIES AND APPLIANCES.—The Electric Shop, Michigan Avenue and Jackson Boulevard, Chicago, has just issued a handsome 9-in x 12-in., seventy-five-page mail-order catalog of its stock of electrical appliances, devices, fixtures, lamps, etc., for the benefit of patrons living at a distance from Chicago who may wish to order goods. The catalog is very complete and is profusely illustrated, enabling purchasers to select articles with almost the same judgment as by a personal visit to the Electric Shop's own lavish display. In formulating arrangements for mail-order service it has been the aim of the Electric Shop management to provide out-of-town electrical consumers with facilities for selection from an ample stock, at the same time relieving local central stations of the expense and annoyance of carrying their own electric-appliance displays. Copies of the new mail-order catalog have been mailed to a selected list of electrical consumers in a number of the larger cities of the country.

BUSINESS NOTES.

THE REYNOLDS ELECTRIC FLASHER MANUFACTURING COMPANY has moved its Chicago office to 617 West Jackson Boulevard.

NEUHAUSEN & COMPANY.—The firm name of McGrath & Neuhausen Company, dealer in electrical securities, Portland, Ore., has been changed to Neuhausen & Company.

MR. H. A. HUNT has been appointed Eastern sales agent of the Edgar Allen American Manganese Steel Company, with headquarters at New Castle, Del., which appointment was made to fill a vacancy caused by the resignation of Mr. V. W. Mason, Jr.

THE RIGGS & SHERMAN COMPANY has been retained by the city of Grand Haven, Mich., to make an appraisal of the municipal water and light plant. The same company has been engaged by the village of Dresden, Ohio, as engineer for the proposed street improvement.

THE WILLARD STORAGE BATTERY COMPANY has moved its Detroit branch from 227 Jefferson Avenue to 1191 Woodward Avenue, where a salesroom and fully equipped battery repair department will be ready for business after May 15. This branch is in charge of Mr. Max G. Hilman.

THE BAIRD-OSTERHOUT COMPANY, Philadelphia, announces the removal of its offices from 36 South Sixteenth Street to the Stafford Building, 1112 Chestnut Street, Philadelphia. This company represents in the Philadelphia district the Banner Electric Company, Sprague Electric Company, Semet-Solvay Company, and Williams Gauge Company.

AGENS & HOPPER.— The corporation of Agens & Hopper has been formed under the laws of New Jersey to carry on the business formerly conducted by the Electric Motor & Equipment Company. The president is S. H. M. Agens, formerly connected with the Electric Motor & Equipment Company, and Mr. Roland I. Hopper is treasurer. The new company will act as jobber of lighting, power and signaling supplies, with offices at 219 Market street, Newark, N. J.

THE PAGE & HILL COMPANY, dealer in cedar posts and poles, Minneapolis, Minn., has completed the installation of a cedar pole-treating plant in its Minnesota transfer yard. Remarkable savings in the yearly cost of pole-line maintenance may be made by proper treatment of poles, it having been demonstrated that suitable preservation will extend the effective life of the pole by two or three times. The demand for treated poles is increasing, and to meet these requirements the Minnesota yard plant has been established.

BURGOON-MATTHEWS ELECTRIC COMPANY.—C. E. Burgoon and H. W. Matthews have formed the Burgoon-Matthews Electric Company with headquarters at Atlanta, Ga. The company will conduct a general wholesale and retail electrical supply business, and will represent a number of manufacturers of power-station equipment. Mr. Burgoon was formerly chief engineer of the Federal Building, Chicago, Ill. Mr. Matthews was formerly associated with the Westinghouse Electric & Manufacturing Company as an electrical engineer.

WOODMANSEE, DAVIDSON & SESSIONS, engineers, Chicago, have been incorporated to do general consulting work in electrical and mechanical engineering. The offices of the company, commencing June 1, will be at 1048 First National Bank Building. The members of the firm are Mr. Fay Woodmansee, for nine years in charge of electrical work for Sargent & Lundy; Mr. C. J. Davidson, for thirteen years chief engineer of the Milwaukee Electric Railway & Light Company; and Mr. E. O. Sessions, who has been connected with the General Electric Company and subsidiary companies for the past twenty years.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, Geo. S. Emery, 11 N. Royal St., Mobile, Ala. Annual convention in November.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next semi-annual meeting at Toronto, Canada, September or October, 1911.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York. Next meeting at Philadelphia, Pa., Sept. 5, 6 and 7, 1911.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-Treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September. Annual convention, Chicago, June 26-30, 1911.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary. H. E. Weeks, Davenport, Ia. Annual convention, Atlantic City, N. J., October 9-13, 1911.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York. Annual convention, Atlantic City, N. J., Oct. 9-13, 1911.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 9-13, 1911.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernst Merritt, Cornell University, Ithaca, N. Y.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Thorpe, Little Rock, Ark.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 135 Adams St., Chicago. Next meeting, Boston, Mass., June, 1911.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, J. Andreucetti, Chicago & Northwestern Railway, Chicago. Next annual meeting (Hotel La Salle, Chicago), November 6 to 10, 1911. Semi-annual meeting, Washington, 1911.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. Wilcox, Lowell, Mass.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, F. D. Morris, 323 Hagerman Building, Colorado Springs, Col. Annual convention, Glenwood Springs, Col., September 13-15, 1911.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d St., New York. Meetings, fourth Tuesday of each month.

ELECTRIC CLUB, CHICAGO. Secretary, N. F. Obright, 1500 American Trust Bldg., Chicago. Meets every Wednesday noon, 303 Wabash Ave., Chicago.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York. Annual meeting at Buffalo, N. Y., June 20, 1911.

ELECTRIC TRADES ASSOCIATION OF PHILADELPHIA. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo. Next meeting in Kansas City, Saturday, June 10, 1911.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January, each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago. Annual meeting Chicago, November 2, 1911.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of directors meets second Thursday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago. Annual convention, Chicago, 1911.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, Indianapolis, Ind. Annual meeting, August 23 and 24, 1911.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Next convention at Ryan Hotel, St. Paul, Minn., Sept. 12-15, 1911.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Ia.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary,, James D. Nicholson, Newton, Kan. Next meeting, Independence, Kan., Sept. 21 and 22, 1911.

MAINE ELECTRICAL ASSOCIATION. Secretary, Walter S. Hyman, Waterville, Maine.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Annual convention on board the S.S. Minnesota, June 19-22, 1911.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, T. C. Gordon, Little Falls, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, A. H. Jones, McComb City Light and Power Co., McComb City, Miss. Annual convention, Gulfport, Miss., June 20-21, 1911.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, N. J. Cunningham. Springfield Gas & Electric Co., Springfield, Mo.

NATIONAL ARM, PIT & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Third convention, Fort Pitt Hotel, Pittsburgh, June 6-8, 1911.

NATIONAL ELECTRIC CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Niagara Falls, July 19, 1911.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 39 Boylston St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, PENNSYLVANIA SECTION. Secretary-Treasurer, Van Dusen Rickert, Pottsville, Pa.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-Treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-Treasurer, H. M. Corse, Columbus Railroad Company, Columbus, Ga.

NATIONAL ELECTRIC LIGHT ASSOCIATION, BALTIMORE SECTION. Secretary, A. W. Hawkes, Jr., Continental Building, Baltimore, Md.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 343 Marquette Bldg., Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, R. Sweetland,, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1913.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Joseph B. Ware, Grand Rapids, Mich.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, J. Bell, David City, Neb.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesdays of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, Ohio, July 25-28, 1911.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. I. E. Sanborn, Ohio State University, of Columbus, Ohio.

ORDER OF REJUVENATED SONS OF JOVE. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill. Annual meeting, Denver, Col., Oct. 16-18, 1911.

PITTSBURGH ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Rombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings, fourth Monday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y. Annual meeting at Pittsburgh, June 27, 28 and 29, 1911.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. B. Moore, 39 Trinity Place, Boston, Mass. Monthly meeting, first Saturday of each month, at the Massachusetts Institute of Technology, Boston.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, D. G. Fisher, 1316 Commerce St., Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y. Annual meeting at Cooperstown, June 27 and 28, 1911.

VERMONT ELECTRICAL ASSOCIATION. Secretary-Treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 145 Monroe St., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Alfred N. Goldsmith, College of the City of New York, New York.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Next annual meeting, Milwaukee, January, 1912.

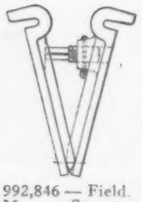
Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 23, 1911.
[Conducted by W. F. Bissing, Patent Law, 2 Rector St., New York City.]

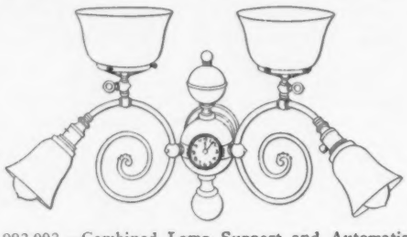
13,244. AUTOMATIC PLAYING APPARATUS FOR MUSICAL INSTRUMENTS; T. B. Powers, New York, N. Y., and M. R. Jewell, Chicago, Ill. App. filed March 1, 1908. Electromagnets operate the keys and are controlled by a music sheet arranged in a box on the table near the instrument.

992,768. ELECTRIC METER; J. Harris, Rensselaer, N. Y. App. filed Sept. 24, 1906. Permanent magnet type of meter with movable armature coil and scale and pointer with a closed conductor member to constitute a dampening device.

992,791. WIRELESS TELEGRAPHY; J. F. McElroy, Albany, N. Y. App. filed Oct. 4, 1905. Sending and receiving conductors with two or more aerials separated a wave length and electrically connected



992,846 — Field Magnet Structure.



992,992.—Combined Lamp Support and Automatic Timing Mechanism.

and another series of aerials separated a wave length and arranged alternately with the first series and station apparatus in circuit with both series, so as to superpose the waves.

992,817. METHOD OF AMPLIFYING ELECTRIC CURRENTS; L. W. Southgate, Worcester, Mass. App. filed July 10, 1908. An alternating-current polyphase generator to the field of which a generating current is applied, a disk rotating with the armature of said generator, coils arranged circularly around said disk and connected electrically to the coils of the armature so that a rotating magnetic field will be produced which will rotate in opposition to the rotation of the disk, and a coil held stationary and placed in said field.

992,836. PARTY-LINE RINGING SYSTEM; C. S. Winslow, Chicago, Ill. App. filed Sept. 16, 1908. Ringing-key circuit with a plurality of ringing-key contacts associated with the ringing key, but excluded from the talking circuit during conversation.

992,846. FIELD-MAGNET STRUCTURE; A. J. Brown, Milwaukee, Wis. App. filed April 19, 1909. For counteracting centrifugal force by means of bracing plates between adjacent poles, which are braced against the coils to support them.

992,851. CONTROLLING DEVICE; H. W. Cheney, Milwaukee, Wis. App. filed Sept. 13, 1909. Avoids the necessity of moving the rheostat arm over the entire set of contacts by providing a variable resistance and a switch to change the line connection from one end of the resistance to the other, thus cutting it out or in as desired, the reverse movement of the arm repeating the action.

992,852. MOTOR-CONTROL SYSTEM; H. W. Cheney, Milwaukee, Wis. App. filed April 15, 1910. Liquid rheostat having a casing containing electrodes with means for pumping a liquid into it and a vertically adjustable overflow weir for determining the height of the liquid, together with means for varying the height of the electrodes with relation to the liquid level.

992,870. CENTRIFUGAL SWITCH; C. B. Hanright, Cambridge, Mass. App. filed June 14, 1909. For single-phase induction motors for cutting auxiliary windings in and out at speed, consisting of a pair of contacts on a rotary shaft controlled by pivoted weighted arms.

992,875. METHOD OF TREATING REFRACTORY ELECTRIC-FURNACE PRODUCTS G. N. Jeppson, Worcester, Mass. App. filed Aug. 21, 1909. For treating carborundum by roasting it under oxidizing conditions and separating the impurities.

992,883. DYNAMO-ELECTRIC MACHINE; A. F. Kwis, Cleveland, Ohio. App. filed May 13, 1909. A housing with spaced ribs so that the dynamo is cooled by air forced through the stator core.

992,943. DYNAMO-ELECTRIC MACHINE; W. A. Dick, Pittsburgh, Pa. App. filed Dec. 31, 1908. An armature with two sets of collector rings and conductors between them, each comprising two offset parts, and flexible connections between the parts, so as not to interfere with the expansion and contraction of the rods.

992,951. PROCESS FOR THE MANUFACTURE OF DUCTILE ELECTROLYTIC IRON; F. Fischer, Berlin, Germany. App. filed Oct. 23, 1909. Precipitates the iron from the electrolyte by electrolysis at a temperature over 70 deg. C. and adds calcium chloride, a hygroscopic salt.

992,952. PROCESS FOR THE MANUFACTURE OF DUCTILE ELECTROLYTIC IRON; F. Fischer, Charlottenburg, Germany. App. filed Aug. 29, 1910. Adds to the electrolyte the salts of sodium chloride so as to produce a hygroscopic double salt of sodium and iron.

992,965. DYNAMO-ELECTRIC MACHINE; A. Kingsbury, Pittsburgh, Pa. App. filed Jan. 11, 1909. The collector rings are mounted upon resilient seats to provide for their expansion.

992,980. OZONE-PRODUCING APPARATUS; O. Patin, Paris, France. App. filed Sept. 29, 1910. Two concentrically positioned tubes with an annular space between, an electrode within the inner tube and a second electrode or coil of wire spirally wound about the outer tube, water flowing through the inner tube, which is ozonized.

992,992. COMBINED LAMP-SUPPORT AND AUTOMATIC TIMING MECHANISM; G. H. Rupley, Schenectady, N. Y. App. filed Aug. 10, 1906. The clock is driven by an electric motor and a rotary contactor is driven by the clock mechanism to close the motor circuit at intervals for winding.

992,993. WEATHERPROOF ELECTRICAL RECEPTACLES; F. J. Russell, New York, N. Y. App. filed March 18, 1908. For cut-out and connecting plugs, with a spiral plug holder lying within the chambered body and having both ends seated on the body and serving as supports for the holder and a line wire terminal mounted on the body and retaining the holder in place.

993,024. COHERER; E. J. Burke, New York, N. Y. App. filed Oct. 29, 1906. The cohering material is fed through a funnel to a vertical tube, passing a plurality of electrodes.

993,034. MEANS AND METHOD OF DEMAGNETIZING PAPER; F. R. Craig, Hamilton, Ohio. App. filed Jan. 9, 1908. For discharging static electricity from the paper by means of a gas burner on a reciprocating carriage, which carriage delivers the sheet. The paper is thus subjected to heat on its delivery from the press.

993,046. SYSTEM OF TRANSMITTING SIGNALS ELECTRICALLY THROUGH CONDUCTORS; F. Fisher, New York, N. Y. App. filed Feb. 3, 1910. For relieving the receiving coil from inductive disturbances, the receiver being connected with the ground and the line on opposite sides of the receiver being connected with the ground through shunt circuits, including a resistance and condenser coupled in series.

993,062. ELECTROSTATIC VOLTMETER; H. E. Heath, Hartford, Conn. App. filed July 6, 1908. A pair of terminal plates with elastic insulating material between them and extending beyond the edges and an indicator operated by the movement of the elastic material.

993,076. COLLECTOR RING FOR DYNAMO-ELECTRIC MACHINES; A. Kingsbury, Pittsburgh, Pa. App. filed Sept. 6, 1910. The collector ring is divided into inner and outer rings, with an interposed resilient spacing means.

993,098. SERVICE TERMINAL BLOCK; G. E. Palmer, Boston, Mass., and W. E. McCoy, New York, N. Y. App. filed Jan. 22, 1910. A service terminal block with a fuse, a switch and a current-measuring device, through which the line and load circuit is established with a by-pass around the fuse and measuring device so that either device may be removed without interrupting the service connection.

993,099. METER-CONNECTION BLOCK; G. E. Palmer, Hartford, Conn. App. filed Oct. 14, 1910. Combined fuse and test connection block for use with either two-wire or three-wire meters, its construction being such that the connections used for test purposes on two-wire meters are also used for testing three-wire meters.

993,105. ELECTRIC SMELTING AND REFINING APPARATUS; J. H. Reid, Newark, N. J. App. filed Aug. 18, 1910. Vertical furnace with inclined arc-producing electrodes and means for dropping the material upon the arc, from which it passes in smelted condition to a lower chamber.

993,123. METER AND OUTLET BOX; J. G. Swallow and W. E. McCoy, New York, N. Y. App. filed Feb. 6, 1909. The box carries the meter and incloses the connection block to prevent tampering, the cover being supported on parallel links.

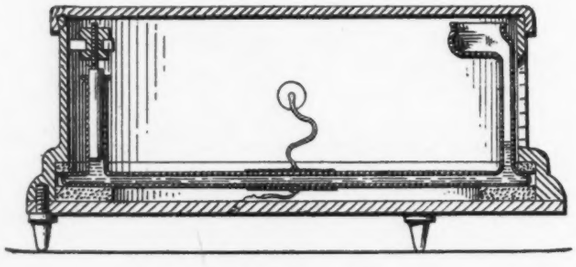
993,157. COMPOSITION FOR TREATING MOLDS USED IN THE ELECTROTYPING ART; G. E. Dunton, New York, N. Y App. filed Sept. 6, 1910. For treating wax electrotype molds by a solution of soda, potash, black lead and glycerine.

993,168. TEMPERATURE INDICATOR OR ALARM; M. L. Huberman, Los Angeles, Cal. App. filed Dec. 17, 1908. Thermostatic alarm, consisting of diaphragm walled chamber which expands and contracts under heat and cold and controls circuit connections to ring a bell.

993,204. BRUSH HOLDER FOR ELECTRIC METERS; G. A. Scheeffer, Indianapolis, Ind. App. filed Jan. 14, 1910. For removing and replacing the brushes of the meter without changing adjustment by mounting them upon a rocker arm between adjustable stops.

993,266. TRAIN-CONTROLLING SYSTEM; W. O. Medford, Spokane, Wash. App. filed March 14, 1910. Applies the brakes when a train enters and occupies block, the first train setting a trip and the control being effected by circuit closers actuated by a wheel of the train.

993,310. ELECTRIC MOTOR METER; P. May, Charlottenburg, Germany. App. filed March 10, 1908. Motor meter with permanent magnet and rotating coil armature in which the friction is avoided and compensated. A rotatable armature in the magnetic field is in series with the load and has a sectional commutator with brushes



993,062.—Electrostatic Voltmeter.

for connecting them with the circuit arranged on a lever which is turned under the influence of the strength of the current flowing in the circuit. A greater proportional torque is thus afforded when the load is low.

993,311. CONNECTION BLOCK; W. E. McCoy, New York, N. Y. App. filed Aug. 24, 1909. For connecting and testing meters. The block has an insulating base, a long terminal strap, two meter terminal straps, an additional terminal strap, a removable fuse and a removable connector between the meter terminal strap and the extended terminal strap.

993,316. METER FOR ELECTROMAGNETIC WAVE COMMUNICATION; G. W. Pickard, Amesbury, Mass. App. filed July 1, 1907. For measuring wave energy by operating a receiver alternately by a local source of energy which can be measured and by the energy of the source of the waves.